OCTOBER 1, 1936

FIRST AERO WEEKLY IN THE WORLD

REGD. AT THE G.P.O. AS A NEWSPAPER

1 3 1936

FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

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Type 142

"Bristol"

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FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

Editor C. M. POULSEN

Managing Editor G. GEOFFREY SMITH

Chief Photographer JOHN YOXALL

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Johannesburg's Jubilee Race

ONE may look upon the Schlesinger air race to South Africa as merely an ordinary race over a rather unusually long course, or one may try to get a little past the obvious and attempt to foresee what the race could, and should, mean to the future of Empire air transport. If one looks back on the history of flying, it is found over and over again that the air race of to-day, the "stunt" if you will, becomes the ordinary commercial everyday air route of to-morrow. Viewed in that light, the import of the start of nine competitors from Portsmouth last Monday morning assumes a different complexion.

As Victor Smith's Sparrow Hawk and Charles Scott's Vega Gull, the last two machines to leave, swung out almost side by side over the English Channel, one's thoughts inevitably turned to what this race ought to mean to flying in South Africa. Johannesburg, the most opulent city in the Union, is celebrating the jubilee of its foundation, and is holding a *British* Empire Exhibition which is attracting large crowds of visitors from all over South Africa and from elsewhere. These crowds will witness—perhaps, by the time these words appear, have witnessed—the finish of an *all-British* race from the distant homeland of the Empire. The race might have had an added interest, as a race, if foreign competitors had been admitted to give a flavour of international rivalry; but in this special case it was surely wise to make it a domestic affair of the British Empire. Mr. Schlesinger undoubtedly considered the matter carefully before offering his very generous prizes, and came to the conclusion, quite rightly, we think, that the air race held in connection with the British Empire Exhibition at Johannesburg should be designed to draw attention to British air progress. Johannesburg brought within little more than thirty hours of London will do more to bind our two countries together than anything else could possibly do.

Everyone must regret that the entries were not more numerous, but the race has come at a time when the aircraft industry is very busy with Government orders, and could not take a really energetic interest in the event. Still, though the starters were few in number, every one of them is a modern machine, some of them with a speed of more than 200 m.p.h., and all of them a credit to this country and to the Empire.

Portsmouth as a starting point must be voted a success. The aerodrome is large, has a good surface, and is quite open and free of obstructions on the east side. And, as Lt. Col. Sir Francis Shelmerdine, Director-General of Civil Aviation, said at the official luncheon to the competitors, Portsmouth has been closely associated with the plans for an Empire air base, and will probably still be the home terminal, whatever form it ultimately takes.

Shortcomings

The public arrangements on the aerodrome on the morning of the start were no better than one has come to expect. There was no special enclosure from which the representatives of the Press could be assured of a good view of the start. Despite the gallant efforts of a very few officials and police, considerable numbers of the public contrived to invade the aerodrome, while those whose task it was to describe the event for the benefit of the world at large had to take their chance of seeing the start by looking over the palings of the enclosures. Before the actual start took place, the gate-crashers were herded away from the immediate proximity of the machines, but even so numbers remained so close that if any machine had swung when starting off there might have been a repetition of the recent tragedy at Newtownards in the Ulster T.T. race. Fortunately, nothing of the sort happened. Had the attendance been larger it might have been a very different story.

Britain On Top

A FEW years ago, thanks to Stainforth, Uwins, Gayford, and Nicholetts, and the Supermarine, Vickers, Fairey, Rolls-Royce, Bristol, and Napier firms, Britain held all the three most important world's records. There are innumerable records recognised by the F.A.I., but the only three which matter to people outside purely aeronautical circles are those of (*a*) speed in a straight line, (*b*) height, and (*c*) range. It was a Golden Age, though all too short a one, when those three lay to the credit of Britain.

It is one thing to win a record, but quite another thing to hold it. Competition is fierce, and among the leading aeronautical nations the setting up of a record by one is an incentive to the others to try to break it. After the Schneider contest of 1931, Britain dispersed her high-speed flight, while Italy kept hers in being. The Italians were able to concentrate on the three-kilometre course, and were no longer distracted by the conditions of the Schneider contests, with the natural result that before long Agello succeeded in beating Stainforth's speed by a handsome margin. It was a victory over an unresisting rival, for Britain has made no effort to fly yet faster. The production of the Spitfire proves that Mr. Mitchell has not lost his cunning, but, so far as the world record for speed goes, this country has allowed Italy to keep it.

Uwins' altitude record did not last long, for the Italian, Donati, soon topped it. As the engine is by no means the least important factor in the making of a record, we could as a nation rejoice that a Bristol Pegasus contributed to Donati's triumph. Quite lately the French pilot Detré went still higher. France, also, thanks to Codos and Rossi, robbed us of the long-distance record. Britain was left with none.

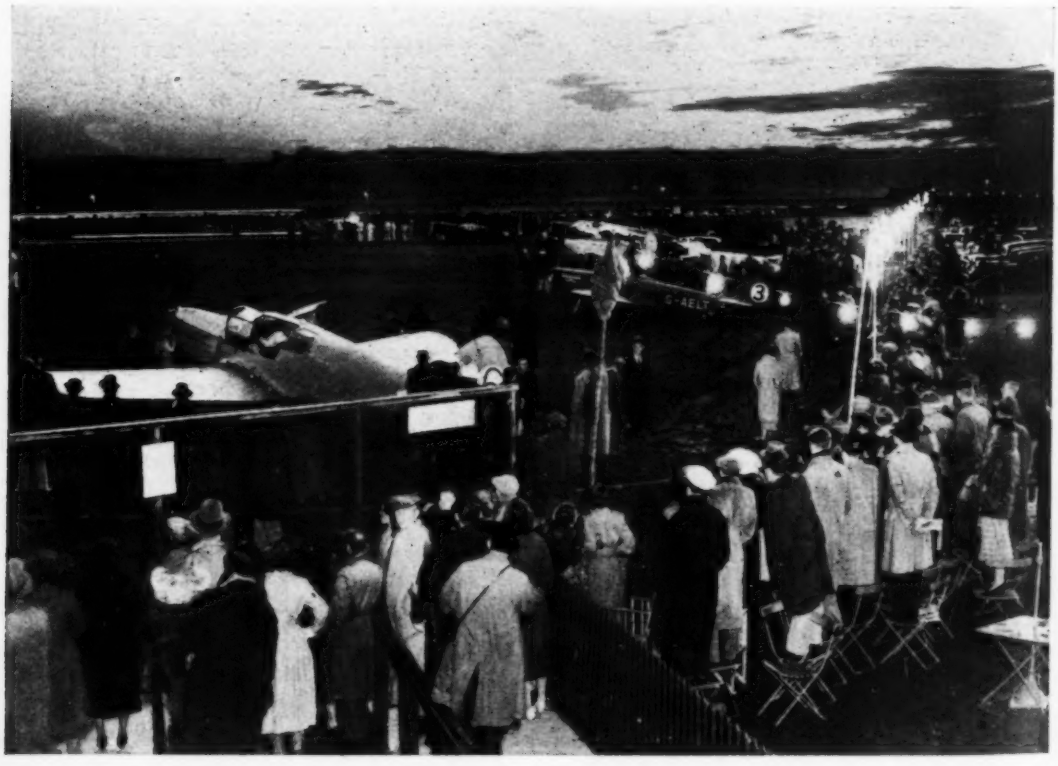
Though the Air Ministry remained indifferent, or at least impassive, over the loss of the speed record, it was not equally apathetic with regard to the other two. Little time was lost in ordering from the Bristol firm two machines, one of which was to make a new attempt on the long-distance record and the other upon the altitude record. The first of these two seems to have been marking time, but every care and forethought was lavished on the altitude machine.

A *National Triumph*

The result is a great national triumph. Squadron Leader F. R. D. Swain has taken this special Bristol higher into the stratosphere than any aeroplane has ever flown before. It is a magnificent feat, and the pilot, as well as the Bristol firm, deserves the heartiest congratulations. Admittedly, this aeroplane cannot climb so high as balloons have risen, but we are not so much concerned with the fact of one man rising higher than any other man has risen as with the technical feat of designing and building a machine heavier than air which can climb higher than any other machine subject to the same limitations.

Britain has once more shown that when she really tries she is able to succeed.

IN THE CLEAR, COLD DAWN



The memorable scene at Portsmouth on Tuesday as dawn broke and the mutter of many engines signalled to the eager crowd that zero hour was at hand.

The Outlook

A Running Commentary on Air Topics

Night Mails in Australia

INLAND letters in Great Britain bear no mark to show whether they have been carried by train or aeroplane, and the man in the London street does not often hear of a letter arriving with such surprising speed that it could only have come by air. In Orkney it is probably otherwise. At any rate, the principle is right, that the Post Office should use air services wherever they will expedite delivery, and that the public should not have to pay extra for that speed.

Australia is about to follow suit. Though the Commonwealth Government has been very loath to agree to the abolition of surcharge on Empire air mails, Sir Archdale Parkhill, the Minister of Defence, has just announced that next year mail planes will fly by night in Australia, and that letters between the capitals of the various States will be carried without surcharge. The surcharge will be maintained for the present on letters to other places in Australia, but Sir Archdale hoped that they, too, would eventually be abolished. This is far-sighted policy, and, like that of Sir Roland Hill, it ought in the long run to pay for its cost and a bit more. At any rate, it is making the Post Office what it ought to be—the servant of the public.

Troops by Air

THE Russian practice of dropping a thousand or more soldiers by parachute at one time has provided illustrated papers with some very striking photographs, and it has aroused intense admiration for the nerve of the Russian private soldiers who make the drops. Conceivably in certain campaigns against an uncivilised enemy this manœuvre might have some military value. It would certainly have a moral effect. In European warfare, however, it is hard to see what useful purpose it could serve. It would take a considerable time to rally the battalion of parachute-men, and a small force of tanks or even of cavalry could mop them up long before they were ready for action.

India has just provided a much more useful example of air transport of troops. Every year a body of troops, usually a battalion, sets out on a three weeks' march to relieve the garrison of Chitral Fort, and Army Headquarters is always in a state of tension until the relief has been safely effected. Recently a small detachment of Sikh sepoys was flown from Rawalpindi to Chitral, and the return trip by air took only five hours. A good many Valentias would be needed to transport a whole battalion, but it is doubtful if the cost in money would be greater in the long run than the cost of the march. In addition there would be no risk of attacks by tribesmen on the way, while the speed of the movement would be an obvious advantage.

V. P. Vindication

ONE thing which the South Africa race has done is to focus attention on the merits of variable-pitch airscrews on modern aircraft having a wide speed range. At Portsmouth it was little short of marvellous to see how the Mew Gulls, for example, picked up immediately the throttle was opened, accelerated at a marvellous rate, and got into the air after a comparatively short run, in spite of their wing loadings of nearly 30 pounds per square foot.

Nor is take-off the only part of aircraft performance which benefits from the fitting of V.P. airscrews. Competitors in the race are getting fuel consumptions of about ten gallons per hour with the new Gipsy Six Mark II engines. Although this is due mainly to the special fuel, with its attendant possibility of raised compression ratios, the V.P. airscrew contributes its share towards the impressive ranges being obtained. No one would argue that *all* aircraft need variable-pitch airscrews, but the modern high-performance types certainly repay the weight and cost.

Apart from the increased safety which results from the greater range, the V.P. airscrew has probably been found of great value for getting off some of the race aerodromes in Africa. In fact, it is safe to assume that without it more than one machine would have had difficulty in "unsticking."

Small V.P.s

GOODNESS knows that our designers are slow enough to adopt new-fangled gadgets for their aeroplanes, but—give them their due—when they have sat back to watch points, and have been convinced that a device is worthy to be included on British aeroplanes, they frequently outstrip all foreign competitors in its development and application. Perhaps the best example of this is provided by the De Havilland variable-pitch airscrews which have been produced for the new series Gipsy Six. Everyone knows that the D.H. airscrew is a Hamilton, built in this country under licence, but everyone does not know that the Americans have not yet produced this type of airscrew in sizes small enough for use on the small inverted in-line air-cooled engine which is fast gaining in popularity over there. Only now are they testing a screw suitable for the Menasco Buccaneer, which is the American counterpart of the Gipsy Six. Before long a V.P. airscrew will be available in this country for the Gipsy Major.

And while on the subject of small V.P. airscrews, we must not fail to hand a bouquet to our good friend M. Ratier, who has unostentatiously done so much toward their development, and who has the happy knack of delivering the goods when the goods are badly needed.

Retractable

RETRACTABLE undercarriages have now been with us for quite a while, and on the whole have behaved themselves very well. There were three designs of retracting gear on Schlesinger machines, and such a race with its full-load take-off under varied climatic conditions should reveal any faults. But the pilots using them have had sufficient experience with their machines to learn to depend on their retracting mechanism, although one *was* toying with the idea of fitting a pair of roller skates to the fuselage bottom!

Of the three gears concerned, that on the Envoy is the best tried, being of the same pattern as used on the older Courier, and leaving a portion of the raised wheels exposed. The advantage of this was unintentionally demonstrated on Sunday, when the pilot of one of the Couriers on the I.O.W. ferry service found his wheels had decided to stay up (an almost unheard-of whim) before landing at Ryde. So he turned back to Portsmouth, set the Courier down, and his passengers just walked into a sister ship and were off again before half the crowd knew what had happened.

THE

(Left) A floodlight view of the Airspeed Envoy (No. 13, Findlay and Waller) on the line in the dawn of Tuesday morning. (*Flight* photograph.) (Right) Swinging the Ratier airscrew of Major Miller's Mew Gull. Note the impressive spinner covering the pitch-operating electric motor. (Below) Monday's preparations—a pleasant scene at Portsmouth airport. In the foreground is Victor Smith's Sparrow Hawk. (*Flight* photograph.)

AS dawn broke at Portsmouth on Tuesday, cold and clear, the nine aeroplanes in the £10,000 Schlesinger African Air Race took off from the City Airport on their 6,150-mile journey—an adventurous journey for some, a deadly monotonous one for others. That was only two days ago, yet by the time these words appear, the great adventure may well be over, with the winner being acclaimed in Johannesburg, *en fête* for its great Empire Exhibition.

Although the event was a formula handicap, the start was virtually a scratch one, allowances being adjusted at Cairo. Actually, the machines left Portsmouth at one-minute intervals. The handicaps are given in the table on page 334.

Four Non-starters

The original entries numbered more than nine. Four machines did not come to the line. They were the new Miles Peregrine, not completed in time; Lt. Misri Chand's Vega Gull, which likewise was not ready; Mr. John E. Carberry's Vega Gull, put out of the running by the nose-over which terminated its Atlantic flight in the hands of Mrs. Markham; and the Mew Gull, which would have been flown by poor Tom Campbell Black.

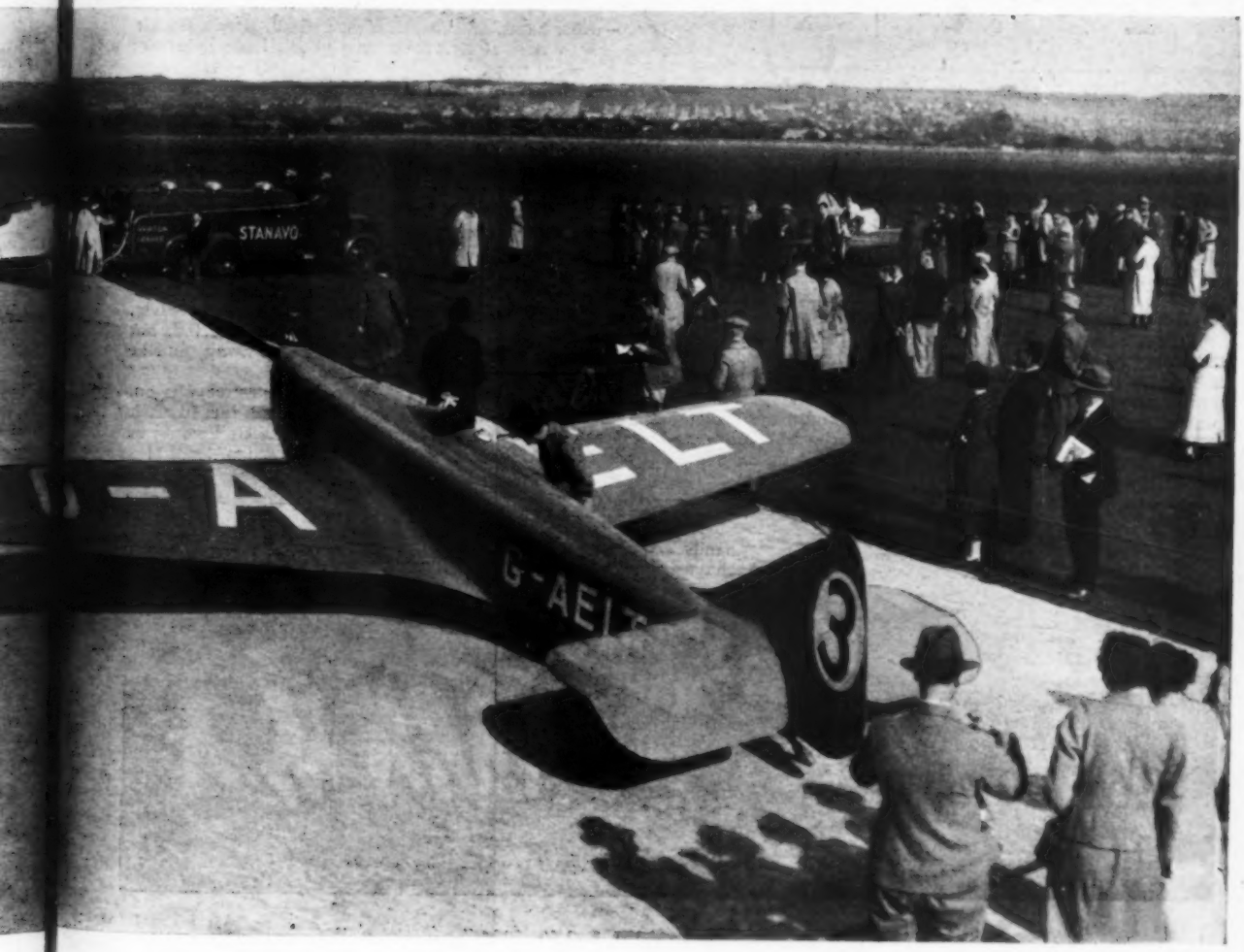
There might have been low cloud and heavy rain over South-Eastern Europe and all manner of meteorological horrors over Africa, but for the start of the race no September morning's weather could have been better. Competitors, officials and the great mass of spectators motored, cycled or walked to the Airport at 5 a.m. under a cloudless night sky.

At the floodlit aerodrome the wind-socks hung limply as the nine machines were wheeled by ghostly figures towards a preliminary starting line. However, with the rising of the sun a wind of some sort might have been expected and, even as the low hills to the east of the airport were outlined against the dawn, the socks filled gently and swung away from their posts.

From 5.30 a.m. onwards there were all the usual accompaniments of an approaching zero hour—made all the more impressive by the semi-darkness and reminiscent of the

JOHANNESBURG RACE

How the Nine Competing Aircraft Left Portsmouth on their 6,150-mile Journey : Big Crowds See a Clear-weather Start : All Machines Take Off Without Incident



never-to-be-forgotten scene at Mildenhall two years ago. Engines were being warmed or run up while exhaust smoke hung patterned in the floodlight beams and mechanics clambered around the vibrating machines.

Meanwhile, a dozen photographers from various papers and agencies had been carefully selected and as carefully shepherded on to the sacred aerodrome—which was ordained as out-of-bounds for all but those with armlets and a multiplication of special badges obtained by devious means. But as these fortunate ones passed the barrier a minor spectatorial leakage occurred; the trickle became an intermittent river which could, nevertheless, have been easily dammed with a little polite firmness and a few more policemen. Eventually, those without badges thronged the aerodrome, while those *with* badges remained meekly behind the hurdles. Mildenhall's lesson had certainly not been learned, even if it had been remembered.

THE HANDICAPS.

Racing No.	Pilot.	Aircraft and Engine.	Handicap Allowance.	Formula Speed
			h. m. s.	m.p.h.
10	Alington and Booth	B.A. Eagle Gipsy Major	21 58 12	116.93
7	Llewellyn	Vega Gull Gipsy Six	13 27 36	139.52
6	Scott	Vega Gull Gipsy Six	13 14 24	140.20
3	Smith	Sparrow Hawk Gipsy Major	10 34 12	149.30
8	Clouston	Hawk Six Gipsy Six	6 25 12	166.12
13	Findlay and Waller	Envoy 2 Cheetah IX	3 13 12	181.73
4	T. Rose	Double Eagle 2 Gipsy Six	3 06 36	182.34
1	Miller	Mew Gull Gipsy Six	0 01 12	200.73
2	Halse	Mew Gull Gipsy Six	Scratch	200.86

At 6.15 a.m. darkness still covered the face of the earth, and the competitors must have felt relieved that the starting time had been put back by an all-important quarter of an hour. It was then that the organisers decided that the competitors should, as a special treat, be allowed to use the whole of the available run; the machines were moved back towards the airport buildings, and the vast number of gate-crashers moved back with them.

With a minute to go it did not seem possible that the race could be started until the crowd had been moved, but at 6.30 a.m. the throttles of the big Envoy were gently pushed forward, while the more knowledgeable spectators prayed that the heavily loaded machine would not swing into the humanity surging against its starboard wing-tip. Slowly the machine gathered speed, the crowd sighed with relief as the twinkling white navigation light lifted in the distance, and a moment later the Envoy was silhouetted against a grey-green sky. The crowd moved up one—to brush against the wing-tip of Halse's Mew Gull.

Hughesdon, Miller, Llewellyn, Bagshaw, Guthrie, C. G. M. Alington and Victor Smith decide to decide it in advance! (*Flight* photograph.)

Those who had not previously seen the V.P. Mews in action must have been astounded by Halse's full-load acceleration, take-off and climb. Within ten seconds of the dropping of the flag the machine was airborne and climbing rapidly; there had not been a moment's anxiety.

The machines with fixed-pitch airscrews showed up badly by contrast, though no one would have noticed the length of their full-load runs if a comparison had not been possible. The Vega Gull's take-off was notably improved. On the other hand, overload C. of A. and all, Rose's Double Eagle, with normal airscrews, was prised loose in a surprisingly short time.

During the entire period of ten minutes, as machine after machine took off with clockwork precision, there were only three mildly bad moments. Miller's Mew Gull descended a slight dip just as the tail was properly in the air and the machine had reached, perhaps, 40 m.p.h.; it rocked and bounced, but five seconds later it was climbing towards the north. Then Victor Smith's metal airscrew was being abortively swung even while the flag dropped; evidently the mixture was too rich for a hot engine. Finally, Scott's Vega required some heavy ruddering to avoid a peninsula of spectators at his port wing-tip, and a few seconds passed before the machine was on a straight course. Meanwhile, the Sparrow Hawk's engine had at last been started, but Smith had to wait until the Vega was well away, and he lost, perhaps, a minute and a quarter.

The crowd flowed over the airport. The race was on. Before some of the earliest departures had turned their cars out of the approach road, Halse's Mew Gull would be passing over the coast of France at operational height!

Yo-heave-ho! Modern version of the Volga boatman, seen on Monday. (*Flight* photograph.)

THE FOUR WINDS

ITEMS OF INTEREST FROM ALL QUARTERS

IT has recently come to light that the Bristol 142 was designed to cruise at 250 m.p.h. on the power of two Mercury VIs of 605 h.p. each. The present engines are rated at over 800 h.p.

With full load the stalling speed is given as 65 m.p.h.; the tare weight is 7,225 lb., and the all-up weight 10,000 lb. Figures for the Blenheim medium bomber are not yet available for publication.

With "G" type Wright Cyclones of 800-odd h.p. each the Martin B-10-B bomber does 240 m.p.h.

Flight photographs figure prominently in a special window display at Selfridges this week in connection with the Johannesburg Race.

Major James Doolittle has ordered a commercial version of a new Seversky fighter for his personal use and as a flying laboratory. It should be capable of over 300 m.p.h.

The funeral of Mr. T. Campbell Black took place at Golders Green Crematorium last Wednesday. His ashes were buried in a private Garden of Rest at Brighton Cemetery on the following day.

Mr. James Mollison arrived in New York on Wednesday of last week to prepare for an Atlantic flight next month in a special Bellanca. Subsequently, he hopes to beat the record for the Cape flight.

The race from Paris to Saigon (French Indo-China) and back is now drawing near, the date fixed being October 26. The starters will probably be two Caudron Goelands, a Breguet Fulgur, a Miles Peregrine and a machine, at present unspecified, piloted by Rene Wauthier.

FLEDGED AT GRAVESEND: A brief description was given in *Flight* of July 30 of the new Wicko two-seater cabin monoplane with converted Ford V.8 engine. The machine is now flying at Gravesend. It is intended to market it at £375.

Canopus, the first of the Short Empire type flying boats, will go into service in the Mediterranean at the beginning of next month.

Mrs. Beryl Markham, the first woman to accomplish the east-west solo Atlantic crossing, was given a civic reception at Southampton on Monday when she returned on the *Queen Mary*. She plans to fly to Johannesburg shortly.

Chinese residing in Malaya have given nearly £150,000 to the Chinese Air Force for the purchase of aircraft.

Mr. James Goodall has died from injuries sustained when his *Pou du Ciel* crashed near Aberdeen Airport.

The Vickers twin-engined medium bomber constructed on the geodetic principle has been adopted by the R.A.F. under the name Wellington. The prototype has two Pegasus engines.

The Soviet Dirigible Building Trust has just launched a new airship, known as the V-8, with a volume of 10,000 cubic metres. She has completed a test flight of 37 hours and will be put into service almost immediately.

BACK FROM THE BACK OF BEYOND: The return to Warsaw of the two Polish Gordon Bennett balloon race competitors, Capt. Janus and Lieut. Brenk, who landed in a desolate part of Northern Russia, and were missing for a fortnight.

Twenty-five Years Ago

(From "Flight" of September 30, 1911.)

"Yet another fatal accident has occurred in America through an aviator being goaded by the jeers of the crowd into flying against his own judgment. At Troy, Ohio, Mr. Frank Miller experienced trouble with the engine of his machine and decided not to fly, but on this decision being communicated to the waiting crowd, they began to demonstrate their anger, and in order to appease them the aviator decided to make a trial. He was flying at a good height when flames were seen to break out round the motor. The machine fell to the ground. . . ."

HERE and THERE

A Send-off

AT a luncheon given by the Portsmouth Airport authorities to the competitors in the race, speeches were made by the Lord Mayor of Portsmouth (Alderman W. J. Avens), Major Miller, Flt. Lt. Tommy Rose, Mr. G. W. Klerck, Mr. Harmel, Councillor J. E. Lane, J.P., Mr. W. Lindsay Everard, M.P., Councillor A. N. Blake and Sir Francis Shelmerdine. The importance of bringing the parts of the British Empire closer together was stressed by several of the speakers, and Sir Francis Shelmerdine reminded the gathering that everyone was hard at work expanding the R.A.F., whose work it was to defend peace, and that without peace there could be no civil aviation.

An American Friend

MR. LESTER D. GARDNER, the Secretary of the Institute of Aeronautical Sciences, U.S.A., is about to pay a visit to Europe, during which he will stay four or five days in London, round about October 29.

On at least one of these days he is likely to be found at the Royal Aero Club, and the mere mention of this fact is certain to prompt a large number of his British friends to meet him there.

Even in the galaxy of hospitable aeronautical Americans Mr. Lester Gardner is conspicuous. It would probably be true to say that everybody in the aeronautical world who has visited the U.S. has been welcomed and counselled by him.

Boulton Paul Aircraft Issue

THE directors of Boulton Paul Aircraft Limited inform their shareholders that the new factory at Wolverhampton is now in operation and that orders in hand and in immediate prospect are much greater than at any time in the company's history. They consider it necessary to make provision for considerable increases in plant and working capital, and they therefore recommend that the capital be increased from £300,000 to £500,000 by the creation of 800,000 additional ordinary 5s. shares.

Shareholders registered on October 5 are to be offered 400,000 of the new shares, ranking *pari passu* with the present ordinary shares, at 5s. 6d. each at the rate of one new share for every complete three ordinary shares then held. Letters of rights will be issued in due course.

Fraternising in Lancashire

THE Lancashire Aero Club's latest excuse for holding a fraternal gathering was an "At Home" last Saturday. The weather was kind enough to permit a number of visiting pilots to find the Avro Aerodrome at the first attempt. In spite of the numerous aircraft which appeared at intervals on the southern horizon, it was a northern pilot, Mr. Lightfoot, in his Hornet Moth, who timed his landing most opportunely, touching down only two minutes before the sealed time, to win the arrival competition.

Flt. Lt. G. Tyson, an Avro test pilot, took up a 626 advanced trainer to show that he had not forgotten the aerobatic tricks he used to play in Cobham's circus. Later he gave a superb exhibition of inverted flying, starting with an inverted spin.

The enclosure and clubhouse were then riddled with theoretical bullets by Bill Humble, who darted over from Sherburn in his Hawk Speed Six, and quickly darted back again.

Meanwhile the Pemberton landing competition was proceeding in comparative security on the other side of the aerodrome. Mr. D. L. Armitage gained his second success.

The most important event was the cross-country trial. Given only true courses and distances, competitors were sent out with sealed maps over a triangular course from Woodford to Huyton (a turning point), Hooton (a landing) and home. They had to estimate wind speed and cruising speed, giving their time for return. The blind course proved too much for six out of the eight starters. Mr. R. N. Birley, a Woodford member, was victorious. Veteran Sir Kenneth Crossley was second.

The afternoon's programme included slow flying by Mr. J. Rogers in a Swallow and another show by Tyson in a Tiger Moth brought north by Mr. Mark Lacayo.

The prizes were presented by Capt. Neville Stack, who was the Club's first full-time instructor.

Where to Look

ENTITLED "Aeronautics," the latest supplement to the Phœnix Book company's technical catalogue gives a list of fifty-six works of reference on various aeronautical subjects. It is obtainable on application to the company at 66, Chandos Street, Charing Cross, London, W.C.2.

Airwork and Misr Airwork

IN a paragraph on the Club News page last week, mention was made by Air Service Training of a visit paid by Mr. Kamal Eloui, managing director of Misr Airwork, to Egyptian students at Hamble. It should be noted that Mr. L. A. Lafone, who accompanied him, is manager of the technical services department of Airwork, Ltd., and is not otherwise connected with Misr Airwork.

Five Ounces per Horse-power

SOME remarkable claims are made for a new engine which is now in process of manufacture for both aircraft and automobile work. Known as the Hughes Stressless engine, it is claimed to give, in the case of the aero unit, the extraordinary power-weight ratio of about 5oz./h.p. Details of the principle are not yet available, but the inventor states that "a novel design enables relative motion to take place between piston and cylinder, with the result that phenomenal engine speeds may be indulged in without stress." It is also claimed that the design offers smoothness of torque approximating to that of the turbine, very small frontal area, and that the engine is to a degree self-supercharging.

The company—Stressless Engines, Ltd.—is in process of formation, with Messrs. J W. R. Thomas, G. Hughes and C. Hughes as directors, and a registered office at 4, St. John's Square, Cardiff.

Forthcoming Events

October 1. R.Ae.S. Students' Section†: Annual General Meeting.
October 8. R.Ae.S. Lecture*: "Tapered Wings," by Dr. G. V. Lachmann.
October 15. R.Ae.S. Students' Section Lecture†: "Recent Developments in Aeronautical Research," by Mr. E. F. Relf.
October 22. R.Ae.S. Lecture*: "Economics of Airline Operation," by Mr. L. T. H. Greig.
October 25. Aero Club de France: Saigon Race.
October 30. Croydon Airport Staff Ball.
November 3. R.Ae.S. Students' Section Lecture†: "Technical Aeronautics in Australia," by Mr. J. V. Connolly.
November 6. Norfolk and Norwich Aero Club: Annual Ball.
November 12. R.Ae.S. Lecture: "Skin Friction," by Dr. F. W. Lanchester.
November 13-29. International Aero Exhibition, Paris.
November 19. R.Ae.S. Lecture*: "Aerodrome Design," by Mr. Nigel Norman.
December 1. R.Ae.S. Students' Section Lecture†: "Stressed-skin Construction," by Mr. C. Moore.
December 10. R.Ae.S. Lecture*: "Civil Flying Boats," by Mr. A. Gouge.
December 17. R.Ae.S. Lecture*: "Profile Drag," by Prof. Melville Jones.
1937
January 14. R.Ae.S. Lecture*: "Magnesium Alloys," by Dr. C. H. Desch.
January 28. R.Ae.S. Lecture*: "Plastic Materials," by Dr. N. A. de Bruyne.
February 11. R.Ae.S. Lecture*: "The Automatic Pilot," by Mr. F. W. Meredith and Mr. P. A. Cooke.
February 18. R.Ae.S. Lecture*: "Compression Ignition Engines," by Mr. A. H. R. Fedden.
February 25. R. Ae.S. Lecture*: "Power Measurements in the Air," by Mr. N. S. Muir.
March 11. R.Ae.S. Lecture*: "Airscrew Blade Vibration," by Major B. C. Carter.
April 8. R.Ae.S. Lecture*: "Control Problems," by Mr. A. G. Pugsley.
April 22. R.Ae.S. Lecture*: "American Engine Development," by Mr. G. J. Mead.

*All R.Ae.S. lectures take place at the Royal Society of Arts, 18, John St., London, W.C.2 at 6.30 p.m. Admission is by ticket obtainable through a member.
†R.Ae.S. Students' Section meetings take place at 7 p.m. in the R.Ae.S. Library.

THE OTHER SWASTIKA

Quite a number of people have wondered whether certain Ansons, seen recently on test, were intended for Germany. Actually the batch is for Finland, and one of the machines is seen below in the hands of Flt. Lt. Geoffrey Tyson, erstwhile display aerobatic expert, and now an Avro test pilot. On the left—taken at 17,000 ft.—are Eng. Laurila (from Finland), Flt. Lt. Tyson, and Mr. H. Lloyd of the works technical department. (*Flight* photographs)

BRITAIN HIGHEST!

Special Bristol Monoplane Piloted by Sqn. Ldr. F. R. D. Swain Recaptures World's Altitude Record by Ascent of 49,967 ft.

SUBJECT to official homologation by the F.A.I., the world's altitude record now stands to the credit of Great Britain with a height of 15,230 m. (49,967 ft.).

This magnificent performance was carried out last Monday by Squadron Leader F. R. D. Swain, of the Royal Air Force, on a Bristol monoplane fitted with a Bristol Pegasus of special type. The preparations for the record flight have been going on for some little time, but not until now has it been possible to refer to the fact.

The existing record of 48,674 ft., standing to the credit of the French pilot, Detré, flying a Potez, is thus broken by 1,293 ft. Sqn. Ldr. Swain took off from Farnborough at 7.30 a.m., and landed at Netheravon, Wilts., at 10.50 a.m.

Sqn. Ldr. Swain, who is a Portsmouth man, was seconded to the R.A.F. from the Army in 1922. He graduated as a pilot at No. 5 F.T.S., Sealand, and then attended a course of armament instruction at Eastchurch, afterwards being posted to No. 2 (Army Co-operation) Squadron at Andover for flying duties.

After passing a flying instructor's course at the C.F.S., Upavon he served with different squadrons at home and overseas, and in the autumn of 1933 he joined the Experimental Section of the Royal Aircraft Establishment at Farnborough as experimental test pilot.

The preparations for the record altitude flight, and the general research programme connected with it, were undertaken under the immediate direction of Mr. H. E. Wimperis, Director of Scientific Research at the Air Ministry. The aeroplane and engine were designed and built by the Bristol Aeroplane Co., Ltd., at the request of the Air Ministry, and in this connection it is of interest to recall that in 1932 Capt. Cyril Uwins, Bristol's chief test pilot, established a world's altitude record by flying to 13,404 m. (43,977 ft.) in a Vickers Vespa biplane specially converted by the Bristol Company. This machine was fitted with a supercharged Bristol Pegasus engine. There is thus a degree of poetic justice in the fact that the recent record breaker should also be of Bristol design and manufacture. Mr. Roy Fedden, chief of the Bristol engine department, and Capt. F. S. Barnwell, Bristol's chief aircraft designer, share with their respective staffs the honour of having produced the combination which has just entered the name of Great Britain once more on the list of world's records.

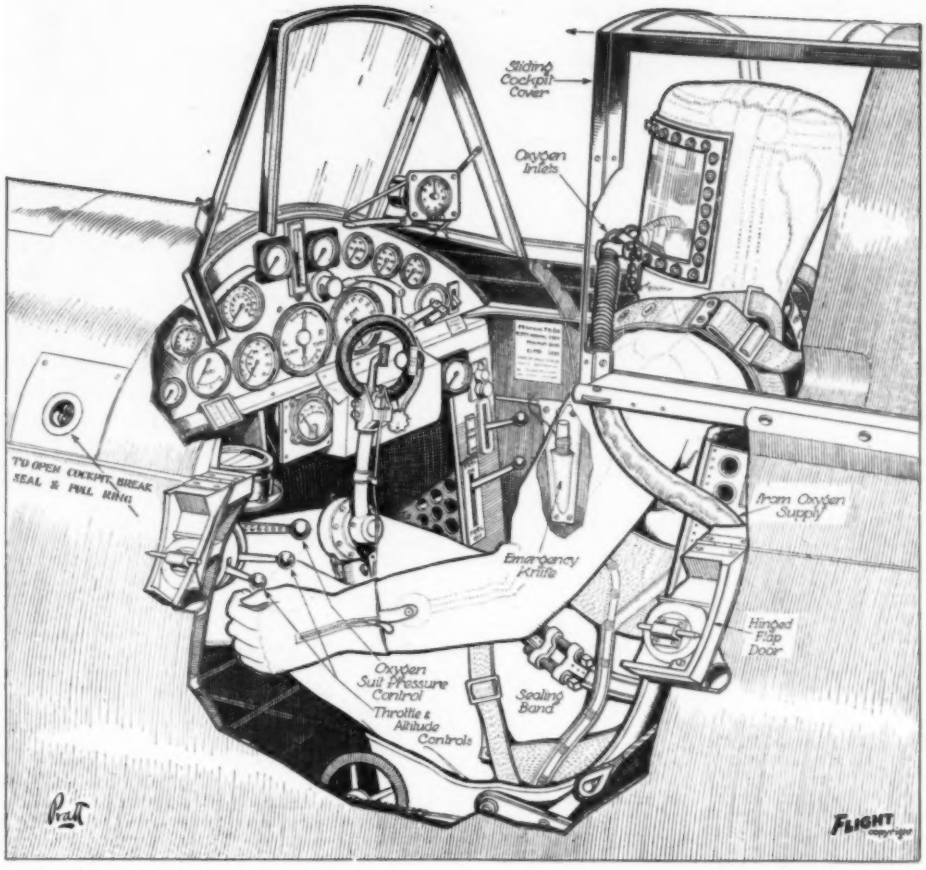
Known as the Bristol 138, the record-breaking machine is a low-wing cantilever monoplane which, except for its size, reminds one very much of the little Bristol Brownie which

HIGH-SCHOOL LESSON—I

"Now watch!"

"A little French chalk to get one's hand in."

"Now for the hat—most important."



took part in the Lympne light plane trials some ten years ago. For the sake of lightness the machine is constructed mainly of wood, except, of course, the engine mounting and cowling. The original estimate for tare weight was 4,420 lb., and when the machine was finished it was found to weigh 4,391 lb., so that the original guess was very close indeed. Loaded for the altitude flight the machine weighed 5,310 lb., a figure which gives a wing loading of 8.53 lb./sq. ft. Induced drag is of great importance in an aircraft which is to have a high ceiling. In the Bristol 138 the span is 66 ft., and the span loading works out at 1.22 lb./ft.^{2}. With its large span it seems likely that the machine is the largest single-seater aeroplane ever built.

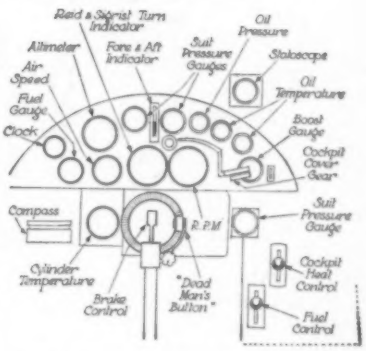
Constructional Features

Of constructional features it may be of interest to note that the wings are built in three sections, of which the central section is integral with the fuselage and has three main spars with plywood webs and mahogany flanges. The covering is plywood sheeting, known as "Teago" three-ply, in some parts less than 1 mm. thick. The fuselage is a rectangular-section *monocoque*, with plywood skin glued and screwed through the mahogany longerons and struts, the whole being faired afterwards to produce a good low-drag shape. It will be seen from the photographs that the sides of the fuselage are left flat towards the stern, probably to increase the directional stability.

An undercarriage of conventional fixed type is used. This was adopted because in a machine built for this particular purpose weight is of more importance than drag, and a retractable undercarriage, with its extra weight, was not considered worth while. Dunlop wheels and brakes are fitted.

The engine fitted in the Bristol 138 is a special type of Bristol Pegasus known as the P.E.VI S. Its most interesting feature is the two-stage blower, which gives a degree of supercharge not attainable with a single-stage unit. The blower drives incorporate clutches, so that the pilot can use the engine as a naturally aspirated engine until a certain height has been reached. This is necessary to avoid feeding too dense a charge of mixture into the cylinders at low heights. The double-stage supercharge heats up the air in the induction system, and to prevent excessive heating up, an inter-stage air cooler is mounted under the fuselage, just aft of the engine.

Numerous instruments enabled the "pressure-suited" pilot to know at any moment what his aeroplane and engine were doing. The actual recording altimeters were carried in the wings, but an ordinary altimeter in the cockpit informed Sqn. Ldr. Swain of his height at any time during the flight.



A total petrol capacity of 82 gallons is provided, 70 gallons being carried in the lower main tank and 12 gallons in the upper, to which fuel is fed from the lower by pump. The smaller tank gives gravity feed to the engine, and its capacity suffices for about a quarter of an hour's flight. The fuel used in the altitude record flight was a special petrol developed from the standard grade of Shell Ethyl aviation gasoline of 100 Octane number, and is known as S.A.F.4. It is chiefly remarkable for its high anti-knock value, which exceeds that of pure iso-octane. The high degree of supercharge from the two-stage blower results in a high mixture temperature, and this tends to promote detonation, so that a high anti-knock value is essential. Lubrication presented its own special problems, and after much laboratory work a standard grade of Shell Aviation oil was chosen as best complying with the

HIGH-SCHOOL LESSON—II

"We screw up the belt clip to set our seal on the inner man."

"And so on board (very 'Things to Come' this bit)."

"The good old Hucks is still used where weight is a consideration."

special requirements which the record flight would involve.

No figures relating to the performance "on the way up" during the record-breaking flight are yet available, but it may be of interest to quote some performances calculated before the machine made the flight. The initial rate of climb from ground level was estimated to be 1,040 ft./min., with the engine developing 370 b.h.p.; an altitude of 10,000 ft. should be reached in 9¼ minutes, and at that height the machine should be climbing at the rate of 1,060 ft./min., the engine then developing 335 b.h.p.

Calculated Figures

To reach a height of 40,000 ft. should, it is estimated, take but 35 minutes, and at that height the rate of climb should be as high as 1,430 ft./min., the engine developing 457 b.h.p. After 40,000 ft. it was expected the rate of climb would decrease, but at 50,000 ft., which should be reached in 46 minutes, it should still be 580 ft./min. with the engine developing 380 b.h.p. The calculated service ceiling (the height at which the rate of climb has dropped to 100 ft./min.) was 54,000 ft., and it was thought that this height should be reached in about 63 minutes. It will be obvious that these are theoretical figures, and that they may not have been adhered to closely during the actual record flight.

The pilot is seated in a very roomy cockpit, which is heated by air from the oil coolers in the wings, the degree of heating being under his control. Instruments on the panel in front of the pilot include turn indicators and fore-and-aft levels by Reid and Sigrist, oil pressure gauges and oil thermometer inlet and outlet by Negretti and Zambra, airspeed indicator and fuel tank contents gauge by Smiths Aircraft Instruments, engine speed indicator by Watford, designed by the R.A.E., and pyrometer by Weston Electrical Instruments.

Special instruments for recording the altitude have been produced by the R.A.E. Known as barothermographs, these instruments record atmospheric pressure and temperature. They are mounted, one on each side inside the wings, on springs to insulate them from engine vibration. The instrument includes a hollow drum around which is wrapped a thin sheet of smoked metal. The drum is rotated by the expansion and contraction of the outer skin of a coil of strip metal due to temperature changes. A pointed arm pressing on the smoked metal sheet causes a scratch to be made. The arm is moved by the action of atmospheric pressure on a series of flexible boxes made of very thin metal, from which most of the air has been exhausted. The line scratched on the surface of the smoked metal sheet makes it possible to determine the atmospheric pressure at the greatest altitude, and the temperature of the air at all lower altitudes. An ordinary altimeter specially arranged to give readings up to 60,000 ft. is mounted in the cockpit to allow the pilot to know his approximate height. This altimeter, by the way, is one of Smith's.

To enable the pilot to stand the extremely low pressure encountered at about 50,000 ft. (approximately one-ninth of ground-level pressure) a special "pressure-suit" has been produced by the Siebe Gorman Company. This suit is based upon the work of the late Professor J. S. Haldane and Sir Robert Davis, in conjunction with the Air Ministry. The suit

(*Concluded on page* 348.)

HIGH-SCHOOL LESSON—III

"Per Pegasus ad Astra."

"Down to two feet once more"

"What d'you know about that?"

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STATIC THRUST of AIRSCREWS

By W. R. ANDREWS, A.F.R.Ae S.

IN view of the increase in wing loading of aeroplanes and the more extensive use of v.p. airscrews, a knowledge of the static thrust has become imperative. In "The Aircraft Engineer" of August 29, and September 26, 1935, Dr. G. Lachmann stated his views of the effects of airscrew-engine combinations and, it may be remembered, expressed the opinion that model tests were of little use in predicting full-scale values. This view was challenged by C. N. H. Lock and H. Bateman, of the N.P.L. in an article in "The Aircraft Engineer" of October 31, 1935. Lock and Bateman made no attempt to allow for the known interference between airscrew and body when analysing the full-scale results. Now Mr. Andrews carries the investigation a step farther, and finds that by allowing for the effects of interference and slipstream remarkable agreement between model and full-scale results can be obtained.

WITH the advent of the really high speed aeroplane, the question of take-off has become of paramount importance. Before any reliable estimate can be made of the run necessary for the aeroplane to gain flying speed, it is imperative that the thrust should be accurately known.

It is possible to forecast, with reliable accuracy, the thrust of an airscrew over the flying range, but the question of the static thrust seems to require further attention. Knowing the thrust both over the flying range and when stationary on the ground, one finds it an easy matter to fill in the thrust over the intervening period by extrapolation.

As is the case at forward speeds the thrust developed by the airscrew (*i.e.*, tension or compression in the airscrew shaft) is used up as follows :—

(1) Interference due to the introduction of a body in the slipstream.
(2) Drag of the parts in the slipstream.
(3) Residual thrust available for giving an acceleration to the aeroplane.

In other words the gross thrust (Tg) is given by

$$Tg = T_1 + T_2 + T_3$$

In a previous article (Ref. 1) it was demonstrated that for any airscrew-body combination $\frac{T_3}{Tg}$ was a constant and for a tractor aeroplane could be expressed as

$$\frac{T_3}{Tg} = \text{Slip factor} = 1 - \frac{3.21\ hK_B\ S_w}{D^2} - \frac{.253\ d^2}{D^2}$$

which can be written as

$$\frac{T_3}{Tg} = 1 - \frac{.063\ R + .322\ A}{D^2} \qquad (1)$$

Where hK_B = Drag coefficient of parts in the slipstream.
S_w = Wing area associated with hK_B.
D = Diameter of airscrew.
d = Maximum diameter of body.
R = Drag of parts in lbs. at 100 m.p.h. air speed.
A = Maximum cross-section of body = $\frac{\pi d^2}{4}$.

The ideal nett thrust is that obtained with the airscrew in free air (*i.e.*, no body before or after the airscrew). Unfortunately this condition is hard to realise in practice as some sort of body is necessary to house the motor for rotating the airscrew. It follows, therefore, that static thrust tests will usually measure the nett, and not the free, air thrust. The free air thrust can, however, be estimated by means of equation 1, if we have some knowledge of the body used in the experiments. In model experiments it is possible to approximate to the free air conditions by direct measurement as has been done in the tests recorded in R. & M. 1673.

A further effect of the presence of a body near a rotating airscrew is to alter the value of $\frac{V}{nD}$ at which the thrust is zero. For the free air condition the value of $\frac{V}{n}$ when the thrust vanishes is called the experimental mean pitch (Pe). As the body size (in the slipstream) is increased, the value of $\frac{V}{nD}$ for zero thrust increases. It is further noted that when the thrust is plotted against speed (after allowing for slip factor to bring the thrust to free air condition), it occurs at a slightly higher speed for a tractor airscrew with a body. Denoting the speed with body as V_1 and the free air conditions for the same thrust as V then $\frac{V_1}{V}$ = constant.

From an analysis carried out some years ago, the writer found that model test results were approximately satisfied for

$$\frac{V_1}{V} = \left[1 + (.76^2 - .144\frac{Pe}{D} \times \frac{A^{3/2})}{D^2}\right] \qquad (2)$$

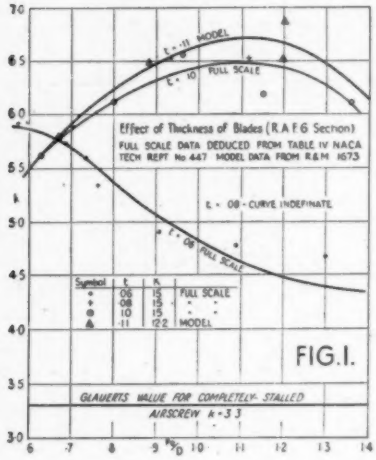
The value of $\frac{V_1}{V}$ also varies slightly with the body drag, but for the purpose of the present investigation the above is sufficiently accurate. The only purpose for which equation 2 is used is to determine the value of Pe/D from tests made with a body in the slipstream. It will be seen later that small errors in Pe/D are negligible, compared with the scattering of the experimental points.

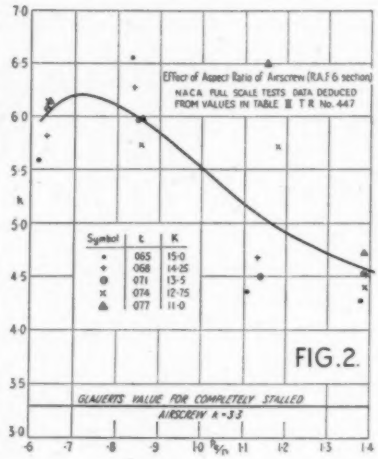
The experimental mean pitch ratio has been adopted as the parameter upon which the performance of an airscrew depends, and not the face pitch/diameter ratio.

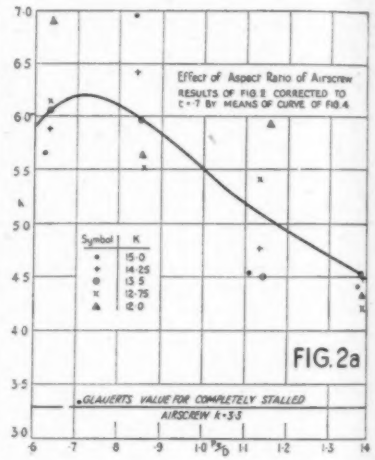
The face pitch/diameter ratio is an arbitrarily chosen parameter whose relationship to the airscrew performance depends upon the blade section employed.

By using the Pe/D ratio as the basis of comparison, it is possible to compare directly airscrews of different blade sections.

It may be argued that, for the purpose of comparing static thrusts, a better basis of comparison would be obtained by using the value of $\frac{V}{nD}$ at maximum efficiency,


Effect of Thickness of Blades (R.A.F.6 Section)
FULL SCALE DATA DEDUCED FROM TABLE IV NACA TECH REPT No 447 MODEL DATA FROM R&M 1673
t = 08 - CURVE INDEFINATE
GLAUERTS VALUE FOR COMPLETELY STALLED AIRSCREW k = 3.3
FIG.1.


Effect of Aspect Ratio of Airscrew (R.A.F.6 section)
NACA FULL SCALE TESTS DATA DEDUCED FROM VALUES IN TABLE III T.R. No. 447
GLAUERTS VALUE FOR COMPLETELY STALLED AIRSCREW k = 3.3
FIG.2.


Effect of Aspect Ratio of Airscrew
RESULTS OF FIG II CORRECTED TO t/c = 7 BY MEANS OF CURVE OF FIG 4
GLAUERTS VALUE FOR COMPLETELY STALLED AIRSCREW k = 3.3
FIG.2a

instead of the Pe/D ratio, to identify each airscrew. If the value of V/nD at maximum efficiency were always a constant value of the Pe/D there would obviously be no difference between the two methods. Since the point of maximum efficiency (at constant Pe/D) varies with blade section, there is some justification on theoretical grounds in support of the argument.

In practice, however, it is not possible to design an airscrew (except by chance), so that its maximum efficiency occurs exactly at some predetermined speed. Then, again, the efficiency curve is not always of such a shape that the V/nD at which the maximum occurs can be readily determined. It is concluded that the practical advantages due to using the experimental mean pitch more than outweigh those to be gained by the use of V/nD at maximum efficiency.

Glauert (Ref. 2) has investigated the question of the completely stalled airscrew, and obtained for the static thrust the relationship.*

$$\frac{Pe \,.\, T_0}{2 \,.\, \pi \,.\, Q} = 1.0 \qquad \ldots \qquad (3)$$

Where Pe = Experimental mean pitch in feet.
T_0 = Static thrust lbs.
Q = Torque in lbs.-feet.

Diehl (Ref. 3) has obtained an empirical relationship for the static thrust of an airscrew in the form of

$$T_0 = \frac{k_{T0} \;\; P}{N \,.\, D}$$

Where P = B.H.P. absorbed by the airscrew.
N = R.P.M. of airscrew.
D = Diameter in feet.
k_{T0} = Constant varying with V/nD at η max.
—Number of blades and blade sections.

His values of k_{T0} are based on both model and full-scale results obtained in the Full Scale Wind Tunnel of the N.A.C.A. The full scale (Refs. 4 and 5) tests were made with airscrews of R.A.F. 6 and Clark Y sections, but no correction has been made to k_{T0} for the effect of interference.

One particular set of tests referred to above was made on an adjustable-pitch airscrew of R.A.F. 6 section, the diameter being changed by cutting off the tip—the tip being afterwards rounded in plan. This particular series gives airscrews of varying solidity with little change in the thickness/chord ratio.

The second series of full-scale tests was made with 6 adjustable pitch airscrews, 3 of R.A.F. 6 sections having thickness to chord ratios near the tip of .06, .08 and .10. The remaining 3 airscrews were similar to the above, but had Clark Y sections instead of R.A.F. 6. The two series provide data on airscrew of constant solidity and varying thickness ratios and blade sections.

The above tests provide data on

(*a*) Airscrew of aspect ratios (*i.e.*, Diamater ÷ max. blade width) of 15 to 12 combined with thickness chord ratios (at .7R) of approximately .07. R.A.F. 6 sections.

(*b*) Airscrew of constant aspect ratio 15 and varying t/c from .06 to .10. R.A.F. 6 and Clark Y sections.

For the purpose of expressing the static thrust in a form which permits easy extrapolation Glauert's formula is used in preference to Diehl's as the former's theoretical value for a completely stalled airscrew gives an indication of the ultimate value at high Pe/D ratios. Glauert's formula is rearranged in the form

$$T_0 = \frac{10{,}000 \; k \,.\, P}{N \,.\, Pe} \times \text{Slip factor} \qquad \ldots \qquad \ldots \qquad \ldots \qquad (4)$$

The theoretical limiting value of k is then 3.3.

The value of k is obtained from Diehl's constant k_{T0} as follows:

$$k = \frac{k_{T0}}{10{,}000} \cdot \frac{Pe}{D} \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad (5)$$

The conversions are given in Tables 1, 2 and 3, and the plotted values in Figs. 1, 2 and 3.

Fig. 1 shows the effect of thickness/chord ratio at constant aspect ratio (15) for R.A.F. 6 section blades. The curves are fairly definite for thickness ratios of .06 and .10,

*NOTE.—In his investigation, Glauert has not defined the pitch. The addition of "experimental mean" has been made by the writer of the present article.

TABLE 1.

Data from N.A.C.A. Technical Report No. 447.
R.A.F. 6 SECTION BLADES.

D = 10.0 k = 15 t = .065 Slip factor = .935

V/nD $K_t = 0$	k_{T_0}	$\frac{V}{V_1}$ Estimated.	$\frac{Pe}{D}$ Estimated.	k
1.425	29,000	1.035	1.377	4.27
1.147	36,700	1.036	1.109	4.35
.87	73,200	1.037	.838	6.55
.648	83,700	1.038	.625	5.59

D = 9.5 k = 14.25 t = .068 Slip factor = .927

$\frac{V}{nD}$	k_{T_0}	$\frac{V}{V_1}$	$\frac{Pe}{D}$	k
1.448	30,200	1.041	1.39	4.52
1.180	38,200	1.042	1.131	4.67
.879	68,900	1.043	.843	6.27
.603	85,200	1.044	.035	5.82

D = 9.0 k = 13.5 t = .071 Slip factor = .920

V/nD	k_{T_0}	$\frac{V}{V_1}$	$\frac{Pe}{D}$	k
1.452	30,100	1.049	1.385	4.53
1.200	36,300	1.050	1.142	4.51
.895	64,600	1.051	.852	5.97
.671	87,700	1.052	.637	6.07

D = 8.5 k = 12.75 t = .074 Slip factor = .910

V/nD	k_{T_0}	V/V_1	Pe/D	k
1.470	28,900	1.057	1.390	4.41
1.196	46,100	1.058	1.130	5.72
.911	60,700	1.059	.860	5.73
.677	87,400	1.060	.638	6.13

D = 8.0 k = 12.0 t = .077 Slip factor = .899

V/nD	k_{T_0}	V/V_1	Pe/D	k
1.476	30,700	1.065	1.387	4.73
1.232	50,600	1.066	1.155	6.50
.918	62,500	1.067	.861	5.98
.686	86,000	1.068	.642	6.14

but for t = .08 the points are too scattered to justify a curve being drawn through them.

Fig. 2 shows the effect of aspect ratio with only small variations of thickness ratio. Unfortunately, the effect of thickness ratio is not wholly eliminated and an examination of the plotted points shows a variation with thickness ratio roughly in keeping with that indicated in Fig. 1. (See Fig. 2*a*.)

Fig. 3 shows the effect of thickness ratio on airscrews of Clark Y sections. Here the general shape is similar to Fig. 1, but the values of k are less at the same Pe/D ratio, as is also the variation with changes in the thickness ratio.

This method of analysis indicates that Glauert's value for a completely stalled airscrew is justified, since the curves of Figs. 1, 2 and 3 tend to become asymptotic to 3.3 at high values of Pe/D.

It still remains to be seen how far model tests can be relied upon to forecast full-scale results. In view of the

TABLE 2.

Data from N.A.C.A. Technical Report No. 447.
R.A.F. 6 SECTION BLADES.

D = 9.5 k = 15 Slip factor = 0.927

V/nD $K_t = 0$	k_{T_0}	V/V_1 Estimated	Pe/D Estimated	k
(*a*) t = 0.06				
.60	95,600	1.045	.574	5.92
.767	70,400	1.044	.735	5.59
.946	50,100	1.043	.907	4.90
1.137	40,500	1.042	1.09	4.77
1.355	33,300	1.041	1.301	4.67
(*b*) t = 0.08				
.625	92,000	1.045	.597	5.92
.798	64,700	1.044	.765	5.34
.975	64,700	1.043	.934	6.53
1.167	51,400	1.042	1.119	6.52
1.403	31,600	1.041	1.398	4.77
(*c*) t = 0.10				
.66	82,400	1.045	.632	5.62
.835	70,900	1.044	.800	6.12
1.007	63,000	1.043	.965	6.56
1.205	53,600	1.042	1.156	6.59
1.42	41 500	1.041	1.364	6.11

TABLE 3.

Data from N.A.C.A. Technical Report No 447.
CLARK Y SECTION BLADES.

V/nD $K_t = 0$	k_{T_0}	V/V_1 Estimated	Pe/D Estimated	k
(*a*) t = 0.06				
.60	95,600	1.045	.574	5.48
.778	68,200	1.044	.745	5.07
.962	41,100	1.043	.922	3.78
1.104	34,800	1.042	1.108	3.85
1.36	28,800	1.041	1.306	3.76
(*b*) t = .08				
.638	88,800	1.045	.611	5.42
.801	70,400	1.044	.767	5.40
.966	43,500	1.043	.926	4.03
1.18	34,100	1.042	1.131	3.85
1.365	28,800	1.041	1.31	3.77
(*c*) t = 0.10				
.664	82,400	1.045	.636	5.24
.820	70,400	1.044	.785	5.53
1.00	57,800	1.043	.959	5.54
1.201	40,900	1.042	1.153	4.72
1.388	25,100	1.041	1.334	3.35

foregoing, it is clearly imperative that all results must be compared having regard to the thickness of the blades and the aerofoil section employed. Previous results have indicated that model results are unreliable for forecasting full-scale performance in the static state. In defence of the model tests Messrs. Lock & Bateman (Ref. 6) expressed the view that the aspect ratio is an important factor. From the available results this does not appear to be so, the value of k is practically independent of blade aspect ratio (at any rate between 12 and 15).

The model tests carried out on high pitch airscrews (Ref. 7) form the most complete series for the purpose of comparison. The static thrust condition is taken as the first reading in the tables of that report, which represents the condition with the tunnel fan at rest.

The value of k from the model tests is given by

$$k = \frac{3.3}{2\pi} \frac{Pe}{D} \frac{Kt}{Kq} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (6)$$

The data and calculations are given in Table 4 and the results plotted in Fig. 4. For ease of extrapolation, Fig. 4 has been plotted on a Log. base and some attempt has been made to fill in the gaps for the various thickness ratios by interpolation and extrapolation.

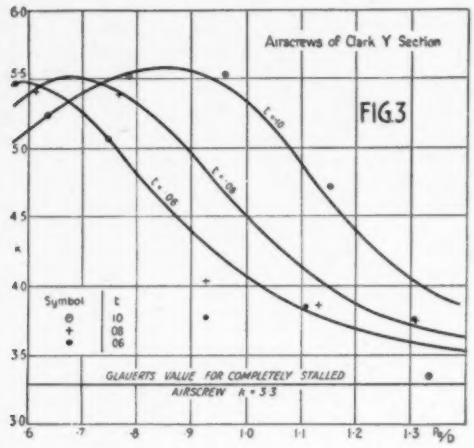


TABLE 4.
Data from R. & M. 1673.
R.A.F. 6 SECTION BLADES.

$\frac{P_f}{D}$	Pe/D	k	$\frac{P_f}{D}$	Pe/D	k
(*a*) Two Bladed Airscrews.			(*b*) Four Bladed Airscrews.		
·3	·467	4.82	·3	·463	3·75
·5	·674	5.81	·5	·647	4·77
·7	·885	6.49	·7	·881	5.30
1.0	1.209	6.88	1.0	1.205	6.13
1.0	1.202	6.52	1.0	1.204	5.99
1.25	1.486	5.98	1.25	1.480	6.07
1.5	1.76	4.96	1.5	1.750	5.15
1.8	2.112	4.63	1.8	2.095	4.85
2.2	2.580	4.25	2.2	2.585	4.62
2.5	2.970	4.19	2.5	2.940	4.52

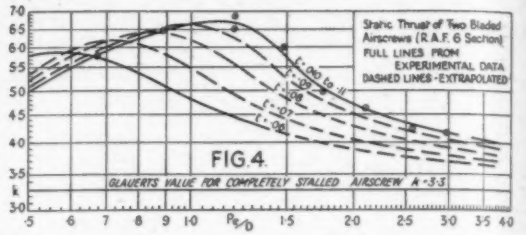
Dr. Lachmann has called attention to the effect of tip speed (Ref. 8). The data he gives shows that for practical variations of tip speed there is a comparatively small variation of the static thrust constant. By " comparatively small " it is inferred that the effect is not greater than the scattering of the points from the full-scale tests. Provided that an upper limit of about 900 f.p.s. for wooden and 950 f.p.s. for thin metal airscrews is imposed the effect of tip speed may be neglected.

The tip speeds employed in the full-scale tests of N.A.C.A. report No. 378 vary from about 550 to 950 f.p.s. This variation does not seem to be sufficient to show any appreciable variation of k from that which would be predicted from model tests employing the same thickness ratio and blade section. It must, however, be remembered that the results must be corrected for interference and slipstream effect before any comparison is permissible.

It is inevitable that, as the tip speed approaches or exceeds that of sound, there must be a fall off of thrust in the static condition, in the same manner as for any part of the flying range. Reference to Dr. Lachmann's curves will provide data on this question.

Since doubts have been expressed as to the value of the static thrust cases given in R. & M. 829 (Ref. 9) none of these results have been referred to.

In an attempt to make the investigation as complete as possible, Fig. 5 has been included. This gives a similar


Static Thrust of Two Bladed Airscrews (R.A.F. 6 Section)
FULL LINES FROM EXPERIMENTAL DATA
DASHED LINES - EXTRAPOLATED
FIG.4
GLAUERTS VALUE FOR COMPLETELY STALLED AIRSCREW k = 3·3
k
Pe/D

set of curves to Fig. 4, except that Clark Y sections are employed instead of R.A.F. 6. Fig. 5 provides the data for estimating the static thrust of V.P. airscrews of American design. A comparison of the curves shows the superiority of R.A.F. 6 section in so far as the static thrust only is concerned.

Before the static thrust for any particular airscrew, of known geometry, can be estimated, it is necessary to know the relationship between the face pitch and the experimental mean pitch. The face pitch is given by

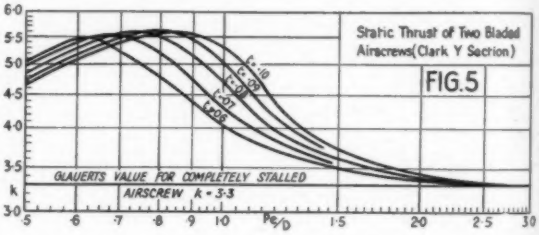
$$\frac{P}{D} = 2.2 \text{ Tan } \phi \quad .. \quad .. \quad .. \quad .. \quad .. \quad (7)$$

Where ϕ is the blade angle at .7R, then the experimental mean pitch ratio for R.A.F. 6 sectioned airscrews is given by

$$Pe/D = \frac{P_f}{D} + k_2 \left[3.5 + \frac{(P_f)^2}{D} \right] t \quad .. \quad .. \quad .. \quad (8)$$

t = Thickness/chord ratio at .7R.
k_2 = 0.364 for wooden airscrews.
= 0.50 for thin metal airscrews.

This difference in k_2 between the wooden and metal airscrew would seem to be due to the different distribution



of t/c along the blade. It certainly has nothing to do with the material of which the blades are manufactured.

To apply the method outlined, the following order will be found most convenient.

(1) From the known geometry of the airscrew calculate the value of P_f/D (Eq. 7) and Pe/D (Eq. 8).
(2) From Fig. 4 read off the value of k corresponding to the known values of Pe/D and t.
(3) From the body drag and size calculate the slip factor (Eq. 1).
(4) Finally calculate the static thrust by means of Eq. 4.

It is assumed that the static r.p.m. of the airscrew with the engine at full throttle is known. For an unsupercharged engine, or one permitting full throttle at G.L., this is not important, since P/N is substantially constant over a wide range of r.p.m. For a supercharged engine, allowing only power at constant boost, P/N is not nearly constant, and a more accurate knowledge of the r.p.m. becomes necessary.

The conclusions to be drawn from the above investigations are :—

(*a*) Model tests on airscrews (after correction for slip factor) with the tunnel static may be used with confidence for the prediction of full-scale static thrust.

(*b*) Model tests can only be applied as at (*a*) above when the model and full-scale screws have the same distribution of t/c and have the same blade sections.

(*c*) Provided that the difference in aspect ratio is not great the model and full-scale screws need not have the same aspect ratios.

(*Continued at foot of next page*)

STRESSES in the RINGS of STRESSED SKIN FUSELAGES DUE to VERTICAL SHEARS

Continuation of Article which Appeared in "The Journal of the Royal Aeronautical Society" of April 1936 : Methods Developed from Least Work Analysis of Structure

By G. F. WALLACE, A.F.R.Ae.S.

ONE of the problems in the strength analysis of stressed skin or monocoque fuselages is the estimation of the stresses in the stiffening rings. Those rings to which the wings, undercarriage etc. are attached sometimes carry complicated systems of concentrated loads, but the majority of the rings and all those in the rear fuselage, generally carry only the vertical shear loads. Various papers have been published on the stresses in rings for general cases and an attempt is now made to present the particular cases for the stresses due to vertical shears for rings of any shape.

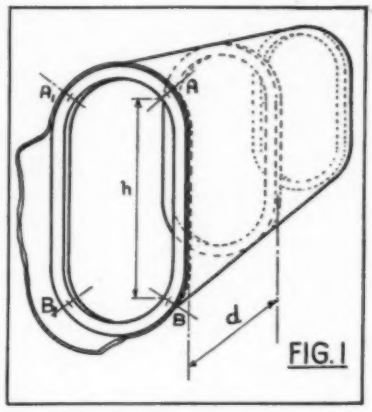


FIG. 1

In the conventional type of monocoque construction shown in Fig. 1, it is usual to assume that the compression and tension loads due to bending are taken by the panels A-A′ and B-B′, while the shear loads are taken by the panels A-B and A′-B′. If P is the total vertical shear at any ring in the fuselage, then from the Wagner theory for beams having thin webs (see N.A.C.A. Technical Note No. 469) :

$$V = \frac{Pd}{2h} \qquad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

where V is the compression load per side acting on the ring and the ring is subjected to a system of loads as shown in Fig. 2.

In general, all rings can be divided into three types, circular or approximately circular rings as in Fig. 3a ; elliptical or approximately elliptical as shown in Fig. 3b ; and rectangular with sides having a large radius of curvature as in Fig. 3c. In the case of ring 3c, it is obvious that the shear panel can be taken as extending from A to B ; in the case of circular or elliptical ring there is no obvious point at which the shear panel can be considered to begin. A reasonable approximation is to consider the angle θ in Fig. 3a to be 30°. Equations for the stresses in circular rings are given in N.A.C.A. Technical Note 462 and those for the type of loading considered are reproduced below.

Left Half of Ring Considered.

x from o to θ.

$$\frac{M}{WR} = \frac{\theta \sin\theta + \cos\theta}{\pi} - \frac{\phi \sin\phi + \cos\phi}{\pi} + \frac{\cos x}{\pi}$$
$$(\sin^2\theta - \sin^2\phi) + \sin\phi - \sin\theta \quad \ldots\ldots \quad (2)$$

$$\frac{P}{W} = \frac{-\sin^2\theta\cos x}{\pi} + \frac{\sin^2\phi\cos x}{\pi} \quad \ldots\ldots \quad (3)$$

$$\frac{S}{W} = \frac{\sin^2\theta\cos x}{\pi} + \frac{\sin^2\phi\cos x}{\pi} \quad \ldots\ldots\ldots \quad (4)$$

x from θ to φ

$$\frac{M}{WR} = \frac{\theta \sin\theta + \cos\theta}{\pi} - \frac{\phi \sin\phi + \cos\phi}{\pi} + \frac{\cos x}{\pi}$$
$$(\sin^2\theta - \sin^2\phi) + \sin\phi - \sin x \quad \ldots\ldots \quad (5)$$

$$\frac{P}{W} = -\frac{\sin^2\theta\cos x}{\pi} + \frac{\sin^2\phi\cos x}{\pi} + \sin x \quad \ldots\ldots \quad (6)$$

$$\frac{S}{W} = \frac{\sin x \sin^2\theta}{\pi} - \frac{\sin x \sin^2\phi}{\pi} + \cos x \quad \ldots\ldots \quad (7)$$

x from φ to π

$$\frac{M}{WR} = \frac{\theta \sin\theta + \cos\theta}{\pi} - \frac{\phi \sin\phi + \cos\phi}{\pi} + \frac{\cos x}{\pi}$$
$$(\sin^2\theta - \sin^2\phi) \quad \ldots\ldots\ldots\ldots \quad (8)$$

$\frac{P}{W}$ and $\frac{S}{W}$ as for x from o to θ.

Where M = Moment at point x
W = Load applied
R = Radius of the neutral axis of the ring.

If θ is 30° as suggested above, the equations become :—

Left Half of Ring.

x from o to θ.

$$\frac{M}{WR} = .219 \quad \ldots\ldots\ldots\ldots \quad (9)$$

$$\frac{P}{W} = 0 \quad \ldots\ldots\ldots\ldots \quad (10)$$

$$\frac{S}{W} = 0 \quad \ldots\ldots\ldots\ldots \quad (11)$$

x from θ to φ.

$$\frac{M}{WR} = .719 - \sin x \quad \ldots\ldots \quad (12)$$

$$\frac{P}{W} = \sin x \quad \ldots\ldots \quad (13)$$

$$\frac{S}{W} = \cos x \quad \ldots\ldots \quad (14)$$

x from φ to π.

$$\frac{M}{WR} = .219 \quad \ldots\ldots \quad (15)$$

$\frac{P}{W}$ and $\frac{S}{W}$ = o as for x from o to θ.

(*Continued on next page.*)

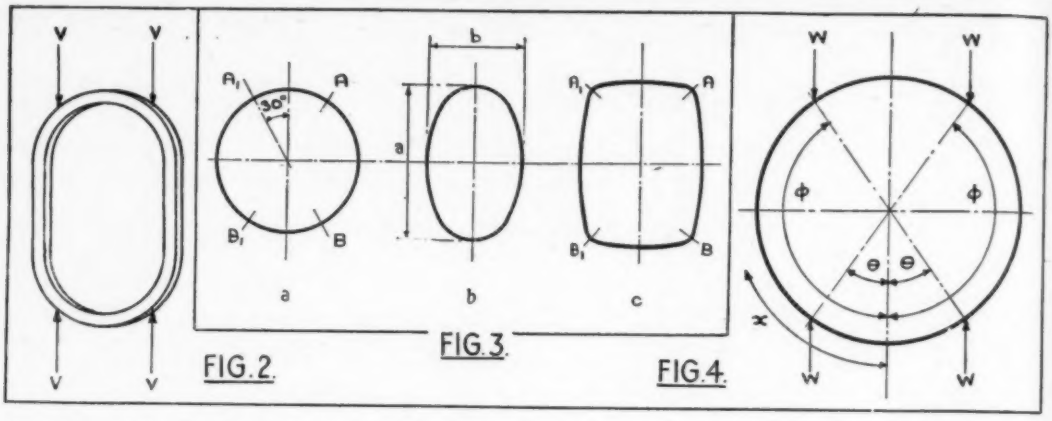
STATIC THRUST—(*Continued from previous page*)

(*d*) It is not known whether the model power is realised in full scale.

(*e*) Provided the full-scale tip speeds of the thin metal screws are within 550 to 950 f.p.s. any correction for this seems unnecessary.

REFERENCES.

(1) Notes on Airscrew—Body Interference. W. R. Andrews. *Aircraft Engineer*, Oct. 27, 1932.
(2) Airscrews for High Speed Aeroplanes. H. Glauert, F.R.S. R. & M. 1342.
(3) Static Thrust of Airplane Propellers. Walter S. Diehl. N.A.C.A. Technical Report No. 447.
(4) Full Scale Wind Tunnel Tests of a Propeller with the diameter changed by cutting off the Tips. Donald H. Wood. N.A.C.A. Technical Report No. 351.
(5) Comparison of Full Scale Propellers having R.A.F. 6 and Clark Y Airfoil Sections. Hugh B. Freeman. N.A.C.A. Technical Report No. 378.
(6) Static Thrust and Model Experiments. C. N. H. Lock, M.A., and H. Bateman, B.Sc. *Aircraft Engineer*, Oct. 31, 1935.
(7) Wind Tunnel Tests of High Pitch Airscrews. C. N. H. Lock, M.A., H. Bateman, B.Sc., and H. L. Nixon. R. & M. 1673.
(8) Airscrew—Engine combinations and their effect on the take-off. G. V. Lachmann, Dr. Ing., A.F.R.Ae.S. *Aircraft Engineer*, Aug. 29, 1935.
(9) Experiments with a family of Airscrews. Fage, C. N. H. Lock, M.A. and H. Bateman B.Sc. R. & M. 829.



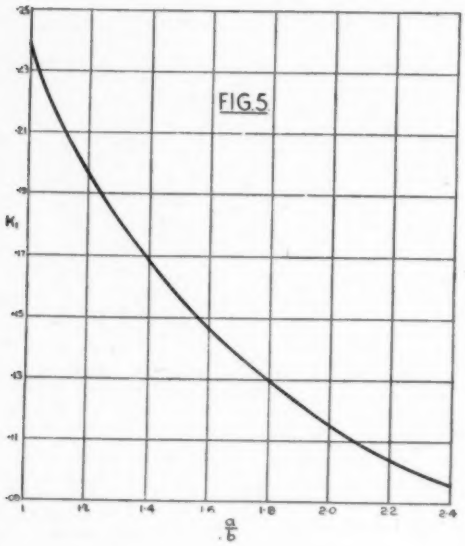
The significance of these angles and the sign of the forces are shown in Fig. 4.

The stresses in elliptic rings for various systems of loads are given by a series of charts in N.A.C.A. Technical Note 444. The moment M_0 and the end load P at the ends of the major axis can be expressed by the equations:

$$M_0 = K_2 aW \quad .. \quad .. \quad .. \quad .. \quad .. \quad (16)$$

$$P_0 = K_1 W \quad .. \quad .. \quad .. \quad .. \quad .. \quad (17)$$

and values for K_1 and K_2 are given in curves in Fig. 5 and



6 in terms of the ratio $\frac{a}{b}$ for θ having a value of 60°

At the minor axis $y - y$, $Py = W \quad .. \quad .. \quad .. \quad (18)$

and $My = M_0 + P_0 a - .5bW \quad .. \quad (19)$

It should be noted in the case of an ellipse that θ is not the angle of the line joining W to the centre of the ellipse but is defined in Fig. 5.

The case of rings of the type shown in Fig. 3c, which are built up of a series of curves, is more difficult to deal with. N.A.C.A. Report No. 509, develops some general equations for the stresses in rings of any shape. Consider the ring cut by the y-y axis as shown in Fig. 7 forming a determinate structure E — F and the origin of $x - x$ to coincide with the top of ring.

Then from N.A.C.A. Report 509, for this type of loading:

$$Xm = \frac{A_2D_2 - B_1D_1}{A_1B_1 - A_2^2} = \frac{D_1 + A_2 \times Xp}{A_1} \quad .. \quad .. \quad (20)$$

$$Xp = \frac{A_2D_1 - A_1D_2}{A_1B_1 - A_2^2} = \frac{D_1 + A_1Xm}{A_2} \quad .. \quad .. \quad (21)$$

$$A_1 = 2\int \frac{1}{EI}\, ds \quad .. \quad .. \quad .. \quad .. \quad .. \quad (22)$$

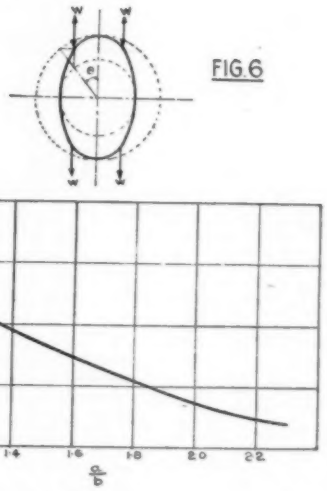
$$A_2 = 2\int \frac{y}{EI}\, ds \quad .. \quad .. \quad .. \quad .. \quad .. \quad (23)$$

$$B_1 = 2\int \frac{y^2}{EI}\, ds \quad .. \quad .. \quad .. \quad .. \quad .. \quad (24)$$

$$D_1 = 2\int \frac{M_0}{EI}\, ds \quad .. \quad .. \quad .. \quad .. \quad .. \quad (25)$$

$$D_2 = 2\int \frac{M_0 y}{EI}\, ds \quad .. \quad .. \quad .. \quad .. \quad .. \quad (26)$$

Xm = bending moment at origin Xp = end load at origin and Mo is the moment at any point due to W in the determinate structure; and ds is an element of length along the neutral axis of the ring.



These integrals can be solved graphically and the results substituted in equations 13 and 14. This process is somewhat laborious and a close approximation can be made by the following method.

Consider panel A-B of Fig. 8 to be a strut with an offset of y at the centre and an end load of P. Under the action of load P the strut bows by a distance of y^0 and the bending moment in the middle is P $(y + yo)$. If this BM was produced by a uniformly distributed load, then

$$\frac{d2M}{dx^2} + u^2M = w \quad .. \quad .. \quad .. \quad .. \quad .. \quad (27)$$

Now assume w replaced by SP where S is a constant.

Then $\frac{d^2M}{dx^2} = SP$ .. .. (28)

$\therefore S = \frac{d2y}{dx^2}$ .. .. (29)

if the curvature of the member followed a square law

then $y = ax^2 + b$ .. .. (30)

$\therefore \frac{d^2y}{dx^2} = 2A$ .. .. (31)

and $S = 2A$ .. .. (32)

$w = 2\,SP$ .. .. (33)

Hence if the curvature of the panel A-B is assumed to follow a square law, the stresses in the ring due to the curvature are the same as the stresses in a straight member having an equally distributed load of 2 SP, where S is found as above. Assume that the points A, A_1 B and B_1 are rigid points, then if the ring is imagined to be cut at A and stretched out it would form a continuous beam loaded as in Fig. 9 and from symmetry it can be seen that

$$M_A = M_{A_1} = M_B = M_{B_1}$$

and the equation for Ma becomes

$$.5a\,M_A + .5bM_Af(a) + 2M_A[.5a + .5b\phi(a)] = (.5b)^3 \times \psi(a) \times 2\,SP$$

where $f(a)$ etc. are the Berry functions for bay A-B.

When M a has been obtained the maximum B.M. in bay A-B can be found by drawing a polar diagram for the bay.

The stresses in rings of type shown in Fig. 3c can be obtained much quicker by this method than by the first method taken from N.A.C.A. Report 509, and although it is only an approximation the possibility of errors accumulating in the graphical integrations of the first method are such that the accuracy of the two methods are comparable. All the methods described above are developed from a least work analysis of the structure, and owing to the various assumptions and approximations the stresses obtained are approximate only. The first approximation made is that the distribution of bending stresses over the cross section approaches a linear one and that the expression for the internal strain energy may be taken as equal to that for a straight member. This assumption is only permissible if the dimensions of the ring section are small compared with the radius of the neutral axis of the ring. If the ratio of radius of curvature divided by depth of cross section is greater than 4, the above assumption will give the stresses in the ring to within 10 per cent. and if this ratio is greater than 10 the stresses can be calculated to within 4 per cent. Another approximation introduced into the analysis is to neglect the work due to axial and shearing forces; this again gives a close approximation only if the ring is thin compared with its radius.

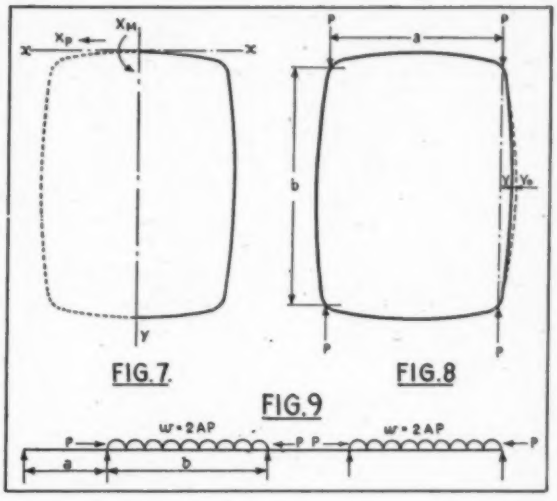


FIG. 7. FIG. 8

FIG. 9

TECHNICAL LITERATURE

STRESS ANALYSIS

"Practical Aircraft Stress Analysis," by D. R. Adams, A.F.R.Ae.S. (Pitman, 8s. 6d. net.)

THERE must be an ever-growing demand for an elementary book on stress work, which will act as a guide and supplement to those admirable and comprehensive Government publications, A.P.970 and A.P.1208. Mr. Adams has set himself the task of meeting this demand and has produced a book, which, in spite of certain faults, is the best in its class yet published in this country. He has avoided the pitfall of including those fundamentals of mechanics and structures which are common to all engineering and can best be gleaned from standard text-books. He has also refrained from giving examples of methods of construction which rapidly become out of date. Less happily, however, he has omitted any proper discussion of the aerodynamic basis of stresswork —of which more anon. The value of the book lies largely in the many sample calculations worked out in full detail.

The first chapter deals with the special terms used in aircraft work and with the estimation and application of the external loads. It is here that we feel very definitely the need for a short but clear description of the relation between speed, attitude and load. Unfortunately, Mr. Adams has not merely omitted to include such a description, but he has given us three definitions of "attitude speed," two of which are wrong. The explanation on page 16 is correct, except for the somewhat loose use of "cruising speed" for "normal top speed," but the example on page 25, and the special Appendix A are incorrect. The careful reader will notice other minor inaccuracies, but we will admit the difficulty of writing a general chapter of this kind in a short space, and pass on.

The second chapter deals with the complex subject of the strength of fittings and joints. There is a great deal of useful information and a number of detailed examples of the methods of checking certain parts. Some reference might well be made, however, to the bending of the bolt carrying a wiring lug, to the need for a distance tube, and to the A.P.970 ruling against bearing on the threads.

The last three chapters deal with the strength of beams, struts and ties, and members in torsion respectively. They are of a higher standard than the first two and even include examples of the use of Howard diagrams. It is a pity that the shear diagram in Figure 3.5 has not been more carefully drawn, as the student ought to be taught what simple checks are available on the accuracy of his arithmetical or graphical work—and the sum of the shears must always equal the load.

It is surprising to find no reference to Southwell coefficients for stressing three-dimensional frameworks, or to strain energy methods for biplane wings. However, such omissions—which are matters of opinion—and sundry mistakes—which are not —may be forgiven to an author who has produced a book which has been wanted for a long time. H. A. M.

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS

REPORTS published by His Majesty's Stationery Office, London, which may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester, 1; St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through any ordinary bookseller.

THE EFFECT OF WEIGHT ON TAKE-OFF AND LANDING. By E. Finn, B.Sc., and S. P. Osborne, B.Sc. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1682. (11 pages and 5 diagrams.) October 16, 1935. Price 1s. net.

Tests have been carried out to provide data to assist in estimating the effects of differences in weight on the flight path of an aircraft from rest to a barrier height of 50 feet or more.

Panoramic photographs of a Vildebeest aircraft taking off and landing were

obtained at total weight of 5,674, 7,340 and 8,200 lb. The distances to take-off and land were obtained from the photographs and correction factors deduced for change of weight.

The following conclusions have been drawn :—

(1) The take-off run is directly proportional to the ratio of the all up weights raised to a power 2.33, a result which agrees well with that obtained in reference 1.

(2) Take-off occurs at the same value of k_L for each weight.

(3) With certain assumptions, a method of calculating the air-borne take-off flight path is suggested. This can be extended to give a method of correcting the flight path for weight.

(4) The landing run is directly proportional to the weight.

(5) Landing occurs at the same value of k_L for each weight.

(6) The air-borne landing flight path appears to be unaltered by change of weight.

FLUTTER EXPERIMENTS ON A MODEL WING FITTED WITH A DEAD-CENTRE AILERON CONTROL. By V. M. Falkner, B.Sc., A.M.I.Mech.E., W. P. Jones, B.A., and C. Scruton, B.Sc., of the Aerodynamics Department, N.P.L. R. & M. No. 1686. (10 pages and 7 diagrams.) October 17, 1935. Price 1s. net.

The tests were undertaken in order to find the effect, as a preventive of wing flutter, of an aileron control having a dead-centre at the neutral position.

The main part of the work consisted in wind tunnel experiments on a model wing which, previous to adaptation to a symmetrical aileron control for the present tests, represented approximately the Puss Moth to ½ linear scale. Critical wind speeds for flutter were observed over a range of aileron angles for the conditions :—

(i) With a dead-centre aileron control, using three different "pilot control" springs and (ii) with a reversible control of the normal type, mainly with one "pilot control" spring.

This work was supplemented by calculations of the critical flutter speeds, with control column locked, of a typical cantilever wing, fitted with a range of dead centre aileron controls defined by a simple law.

The experiments and calculations show that it is possible for a wing fitted with a dead-centre aileron control at the neutral position to flutter when the aileron is displaced by a comparatively small angle from the neutral position. No flutter oscillating over the dead-centre could be induced on the model. However, it is not established conclusively that a motion of this kind is impossible, since theory and model experiments are both subject to certain unavoidable limitations in the investigation of this question.

Profile-drag Measurement

THE MEASUREMENT OF PROFILE DRAG BY THE PITOT TRAVERSE METHOD. By the Cambridge University Aeronautics Laboratory. R. & M. No. 1688. (46 pages and 20 diagrams.) January 16th, 1936. Price 3s. net.

For the improvement of the performance of aeroplanes it is important to be able to measure the drag of their component parts while in actual flight. To do this by direct measurements of force is difficult, but there is an indirect method which involves merely the examination of the "wake" left behind in the air by the component part under consideration. This method is capable of very general application to give estimates of the energy loss due to various parts of an aeroplane in flight or in the wind tunnel. It was therefore desired to develop a technique for determining in flight the profile drag of wings, from observations of total-pressure and static-pressure in the wake, close behind the trailing edge.

After examining the theoretical aspects of the problem accounts are given of an experimental study of the method in a wind tunnel and of applications to a wing of an aeroplane in flight. Two series of flight experiments were made, one with standard fabric wing covering and the other with smooth polished wing surfaces. Each series contains several independent determinations of drag from traverses made at various distances behind the wing.

The method provides an easy and satisfactory way of determining, in flight, the local profile drag coefficient for any given portion of the wing. It enables variation of drag due to changes of surface condition to be determined within about 2 per cent. of the profile drag. The absolute accuracy of the determination of drag may be of this same order, but to obtain definite proof of this requires further and rather elaborate wind tunnel experiments. It is considered unlikely that the absolute values given for the drag coefficients are in error by more than 5 per cent.

With Reynolds number about five million, the profile drag coefficient $(C_D)^*$ of a very smooth wing of 10.5 per cent. thickness/chord ratio and 2 per cent. centre line camber was found to be 0.0069, as compared with a mean value of 0.0090 for a fabric covered wing of substantially the same section, made in accordance with current practice.

It is proposed to continue the experiments on the present wing and on wing of thicker section, with various forms of surface roughness. It is also proposed to examine, by a method which has already been developed, the positions on the wings of the points of transition from laminar to turbulent flow in the boundary layer.

* This is the coefficient $C_D = D/\frac{1}{2}\rho U_1^2 S$ where D is drag, U_1 is air velocity in the neighbourhood of the wing and S is wing area. Thus $C_D = 2k_D$, the coefficient hitherto used in British reports.

ON THE STRESSING OF AEROPLANE WINGS DUE TO SYMMETRICAL GUSTS. By L. W. Bryant, A.R.C.Sc., and I. M. W. Jones, of the Aerodynamics Department, N.P.L. R. & M. No. 1690. (20 pages and 27 diagrams.) February 15, 1936. Price 2s. net.

On the simplest hypothesis of the instantaneous adjustment of circulation around a wing to sudden change of incidence and speed it is well-known that the biggest load due to a gust of given magnitude symmetrically disposed with respect to the aeroplane, occurs when the gust is inclined at about 70° to the line of flight. The effect of a vertical gust, however, does not differ from the maximum by as much as 10 per cent. On the same simple hypothesis, neglecting wing elasticity, aeroplane stability and other relevant factors, it can be shown that the load due to a gust of 70° inclination would depend only on the ratio of aeroplane speed (V) to gust speed (W') and on the quantity $W/\rho SV^2$, which of course is $\frac{1}{2}C_L$ for steady horizontal flight. The wing load is greater as either V/W' or $W/\rho SV^2$ is reduced. It is clear that a given gust will have greater effects on slow speed, lightly loaded aircraft. Heavily loaded aircraft in steep high velocity dives may experience trouble due to horizontal gusts, especially if the gust produces a down load which the structure may not be designed to stand. The purpose of the present report, however, is a study of the effect of two important factors which modify considerably the loading as calculated on the simple "sharp-edge" hypothesis for vertical gusts. These factors are :—

(1) the delay in the establishment of circulation around a wing following a sudden change of incidence or speed—called here for brevity the "Wagner" effect ;

(2) the elasticity of the wings ; only the flexural elasticity is here considered.

The work of Küssner in 1931 showed how large was the reduction in wing stressing on account of the Wagner law, and also how important the flexure of the wings might be in increasing the stresses when oscillations were set up by sharp gusts. But he omitted the effects of the stability of the aeroplane and of the distance between wings and tail (the pitching motion being neglected altogether) effects which should be considered in calculating the motion resulting from increasing gusts of the kind found in wind records. His conclusions are similar for extremely sharp gusts.

It was found that the air forces on an elastic wing are sensibly the same as those on a rigid wing subject to the same gust, so that these forces can be calulcated for a rigid wing and then applied to the elastic wing to find the bending motion of the latter.

Some consideration was given to the basic loads arising from gust vectors of given magnitude and varying inclination and it was found that an inclination of 70° to the line of flight gives rise to the maximum load. For gusts of this constant inclination the basic load depends upon the ratio of aeroplane speed to gust speed and on the quantity $W/\frac{1}{2}\rho SV^2$ which is equal to the lift coefficient in steady flight. Small values of this latter quantity and of the ratio of aeroplane to gust speed lead to large loadings due to the gust.

THE ROLLING UP OF THE SURFACE OF DISCONTINUITY BEHIND AN AEROFOIL OF FINITE SPAN. By F. L. Westwater. Communicated by Dr. S. Goldstein. R. & M. No. 1692. (16 pages and 19 diagrams.) August 22, 1935. Price 2s. net.

The existence of a surface of discontinuity or vortex sheet behind an aerofoil of finite span is well known. The sheet behind an aerofoil may be regarded as a semi-infinite one, terminated by the bound vortex which in the theory replaces the actual aerofoil. As a first approximation the author ignores the bound vortex and treats the trailing vortices as infinite in both directions, so that the problem becomes a two-dimensional one.

This assumption cannot represent conditions in the immediate neighbourhood of the aerofoil, but for points at some distance behind the trailing edge the errors involved will be small. A discussion of the errors is given in the report.

In the numerical solution the sheet is replaced by twenty line vortices arranged in two groups of ten symmetrically about the mid point of the sheet. The vorticity in the two groups is of opposite sign. The velocity components of each vortex were calculated separately, and multiplied by a suitable time factor to give displacements in that time along the tangent to the path at the instant for which the velocity was calculated.

The successive positions of the system of vortices are shown in Figs. 1-17. By drawing a smooth curve through the points occupied by vortices we get some idea of the form of the continuous sheet at the corresponding instant. In Kaden's solution, the form of the sheet at any time is a spiral whose asymptote is the original trace of the sheet. In the present case there seems no reason to doubt that the form of the sheet near the edges is also spiral.

A ROUTINE METHOD OF STRESSING FOR THREE-PLY COVERED FUSELAGES, WITH SPECIAL REFERENCE TO SOME MECHANICAL TESTS ON A PARTICULAR FUSELAGE. By H. Davis, B.Sc., D.I.C. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1694. (4 pages and 4 diagrams.) October 9, 1935. Price 6d. net.

Some recent mechanical tests on a particular wooden fuselage covered with thin three-ply afforded an opportunity for a comparison of theory and experiment for such a fuselage. This report outlines an approximate theory of stressing, convenient for routine use, and indicates the results of the desired comparison on the basis of this theory.

The routine method of stressing described employs the usual engineer's theory of bending and torsion with tension field corrections based on Wagner's theory. The results—mainly as regards deflections—given by the method when applied to the particular fuselage tested are compared with those obtained by experiment. It appears that for the particular fuselage tested the method outlined gives, on the whole, good agreement with experiment, but it should be noted that the comparisons made are not very critical tests of the theory.

NOTE ON EFFECT ON STATIC PRESSURE ALONG THE AXIS OF AN OPEN JET TUNNEL OF (*a*) NOZZLE FLARE, AND (*b*) A RING IN THE COLLECTOR. By F. B. Bradfield, M.A., and G. F. Midwood. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1695. (3 pages and 5 diagrams.) November 1, 1935. Price 6d. net.

In designing an open jet tunnel, power can be saved by keeping the jet length short, since approximately half the total power is expended on the edge of the open jet. If the length is reduced to say 1.25 times the mean jet diameter, the length of body whose drag can be measured in the tunnel without serious corrections due to change in static pressure along the tunnel axis is about 0.75 times the jet diameter. This may restrict the utility of the tunnel, and the present tests were made to find a means of keeping constant static pressure over almost the full length of an open jet tunnel.

Provided that the fan is set back some distance in the collector, so that there is room inside the collector to fit a ring, it seems to be possible to obtain sensibly constant static pressure from nozzle to collector, so that a short jet may be used. There will be a saving in power, primarily because the open jet causes a serious power loss, and shortening the jet effects a saving, but also to a secondary degree because adding the ring will reduce the power needed.

HEAT DISSIPATION OF ETHYLENE GLYCOL RADIATORS AND COMPARISON WITH WATER RADIATORS. By C. Anderton Brown, A.M.I.Mech.E., and F. G. Barlow, B.Sc. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1696. (28 pages and 17 diagrams.) July 26, 1935. Price 2s. net.

With the object of improving aircraft performance with liquid-cooled engines, liquids of higher boiling point than water may be used and ethylene glycol has been employed for this purpose. Experiments with engines have been made but the influence of coolants other than water on the radiator performance has not been sufficiently investigated. This report presents radiator design data for such coolants.

The specific heat of the ethylene glycol used ranged from 0.665 at 90° C. to 0.725 at 146° C. Under the conditions of the present tests it was found that the heat transference, liquid to air, per unit frontal area per degree temperature difference at 100ft. per sec. was from 6 per cent. to 8 per cent. less with ethylene glycol than with water. This arises from two causes, (a) inferior heat transference from liquid to metal, (b) reduction of mass air flow at higher metal temperatures.

The comparative sizes of radiators with water and with any other coolant of known physical properties can be calculated from the estimated metal temperatures, the basis of the calculation being a water radiator of the same tubes and having a known performance. From the example worked out, ethylene glycol, at a maximum temperature of 125° C., permits a large reduction of radiator area (about half) on account of the higher working temperature and the greater proportionate direct heat loss from the engine jacket, pipes and tankage. The percentage of jacket horsepower dissipated apart from the radiator tube block becomes a material factor in the calculation and substantially improves the prospects of cooling by high temperature coolants.

Where high temperature coolants are employed the question of radiator solders is important as the strength of lead-tin solder is reduced with increased temperature.

PORTSMOUTH PARAGRAPHS

Preparations for the Race : Last-minute Changes : A "Spot of Bother" with Tommy Rose : Trying-out the V.P. Props : Nine Starters Arrive in Time

Illustrated with *Flight* photographs and sketches.

THE order of starting in the Race was decided last Thursday by drawing lots; the competitors were to leave, at one-minute intervals, as follows: No. 13 (Findlay and Waller), No. 2 (Halse), No. 10 (Booth and Alington), No. 4 (Tommy Rose), No. 8 (Clouston), No. 7 (Llewellyn), No. 1 (Miller), No. 3 (Victor Smith), No. 6 (Scott).

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As there seems to be some slight confusion about the system of starting the machines it may be explained that the idea was to run the event virtually as a scratch race, though to reduce risk of collision it was arranged to start the machines off at one-minute intervals. This meant a readjustment at the Cairo control, the Airspeed Envoy being detained there for the nine minutes it started ahead of Scott's Vega Gull; similarly, the Mew Gull flown by Halse was to be detained eight minutes at Cairo, the Eagle seven minutes, the Double Eagle six minutes, and so on. The last man to start, C. A. Scott, was not to be detained at all. Thus from Cairo onwards the competitors were spaced as if they had all started level from Portsmouth. In this way the first man to arrive at Germiston would be the winner of the speed race, but the winner of the handicap could not be known until all competitors had arrived and their times been telegraphed to London, where the actual times and the handicap times were compared, the winner being the competitor who had beaten his handicap time by the greatest margin.

(Left) A vice-chairman and an ex-chairman of the R.Ae.C. talk it over—Mr. W. Lindsay Everard, M.P., and Col. Sir Francis McClean (who flew a Short seaplane in Egypt as long ago as 1911). (Right) Mr. Harmel, who is representing the generous Mr. Schlesinger in this country.

The machines mounting the new series of Gipsy Sixes were fitted with boost gauges to measure the "depression" in the induction pipe.

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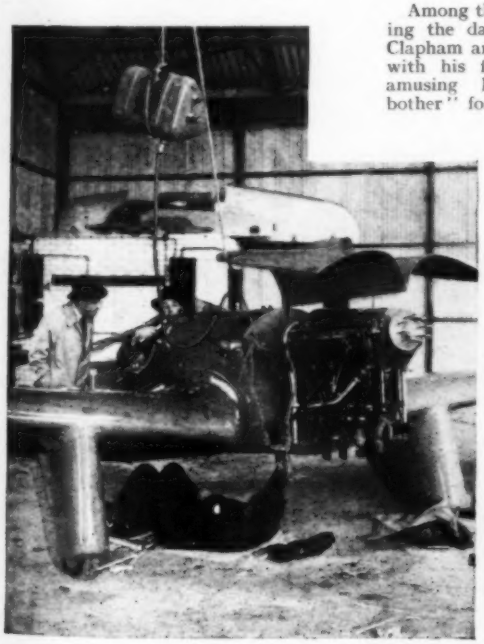
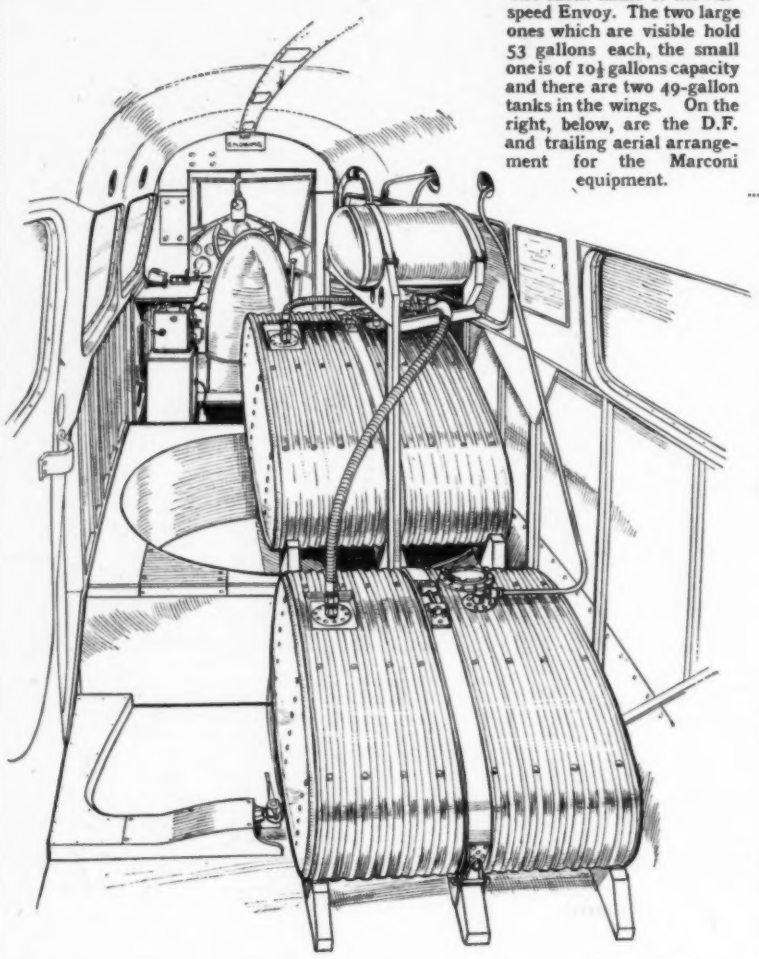
Among the visitors to Portsmouth during the days preceding the start were Clapham and Dwyer, the former staging with his friend Tommy Rose a very amusing little cross-talk "spot of bother" for the benefit of the newsreels.

As the fastest machines in the race the two Mew Gulls were the centre of interest whenever they came out for a test flight. Major Miller had a Ratier V.P. airscrew, while Halse used a De Havilland. Miller's machine did not slow down fast enough, and he had the airscrew stops readjusted so as to get a greater braking effect when the engine was throttled back to make the landing.



(Left) Night shift : Lt. Cdr. C. N. Colson, works manager of Phillips and Powis, submerging into the depths of Victor Smith's Sparrow Hawk for an inspection of the repairs made during Saturday night to the tank, a head of six feet of petrol is being used as a test. (Right) Mr. Jack Bagshaw encourages inflators of the Li-Lo mattresses carried on the Double Eagle.



The cabin tanks of the Airspeed Envoy. The two large ones which are visible hold 53 gallons each, the small one is of 10½ gallons capacity and there are two 49-gallon tanks in the wings. On the right, below, are the D.F. and trailing aerial arrangement for the Marconi equipment.

PORTSMOUTH POINTS NOTED BY ARTIST AND CAMERA

Included in the equipment of the Airspeed Envoy is the new Hobson master control, which simplifies the whole control of the supercharged engines. It is likely to go into fairly large production quite soon.

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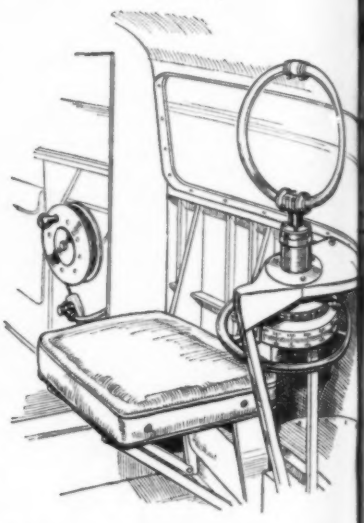
After a test flight on Friday last, in which the wireless and other equipment of the Envoy was tried out, Findlay and Waller went back to Brooklands to carry on the good work of teaching the younger generation to fly. What these two do with their spare time has not yet been discovered.



Major Miller had three copies of a new book about gold mining tucked away beneath his Irvin.

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The Mew Gulls carried parachute flares, to be fired from a Very pistol.

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Llewellyn's Vega Gull and Miller's Mew were both mounting electrically operated Ratier V.P. airscrews. This may have been due to the fact that no spinners were available for the D.H. airscrews. D.H.s had actually tested a "1,000" size airscrew, which is the model used by the new Gipsy Sixes, for ten hours at 2,700 r.p.m. before trouble developed with the spinner.

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A valve in Halse's airscrew became recalcitrant and was temporarily assisted by a piece of string which mysteriously sprouted from a louvre and disappeared beneath the cowling. But De Havilland's V.P. kings soon made appropriate adjustments. The fault lay in the installation.

The official programme of the Race was produced by Mr. F. H. Turner, of Airspeed, Ltd. It was extremely well got up and contained a message from Mr. I. W. Schlesinger, whose London representative, Mr. A. E. Harmel, was one of the most interested spectators during the preliminary work at Portsmouth. The cover of the programme was in green and yellow, the colours of the Springboks. Photographs and descriptions of the machines, contributed by *Flight* were features.

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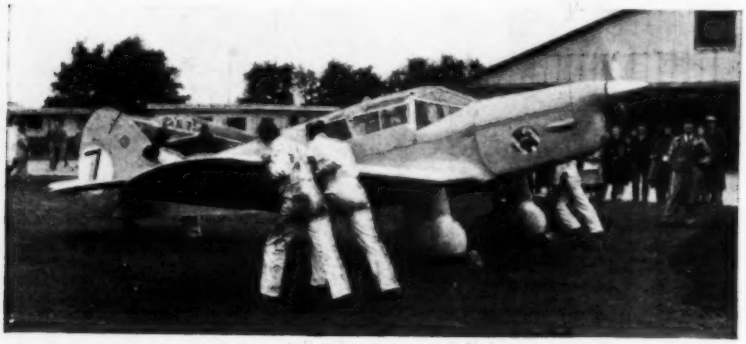
Flight gathers that Mr. Schlesinger is rather tired of being told that the race ought to have been an international one. He had very strong and good reasons for confining it to British aeroplanes.



Resistance to the 205 h.p. of Vega Gull No. 7, manned by F/O. D. W. Llewellyn and C. F. Hughesdon.

In testing various items of equipment on Sunday Mr. Jack Bagshaw took it upon himself to give the Li-Lo mattresses an extended try-out.

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Apparently Tommy Rose and Bagshaw had not quite decided what method they would use to change over places in the air. But although she has only one set of controls the Double Eagle flies hands-off in a truly ladylike manner, so they weren't worrying.

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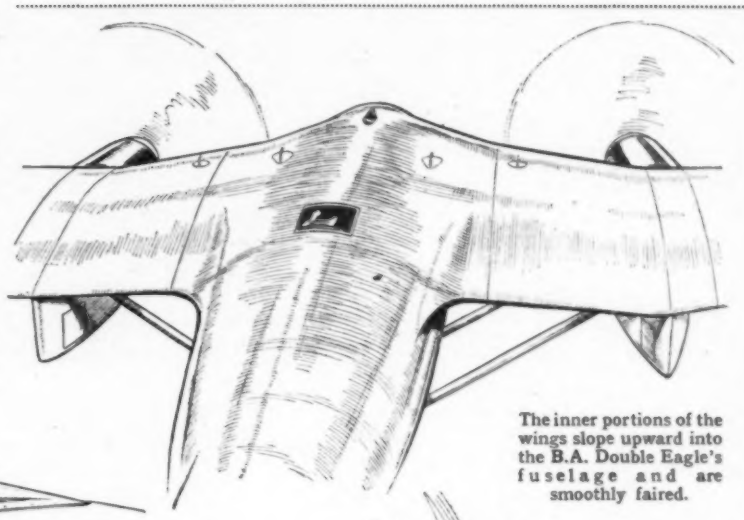
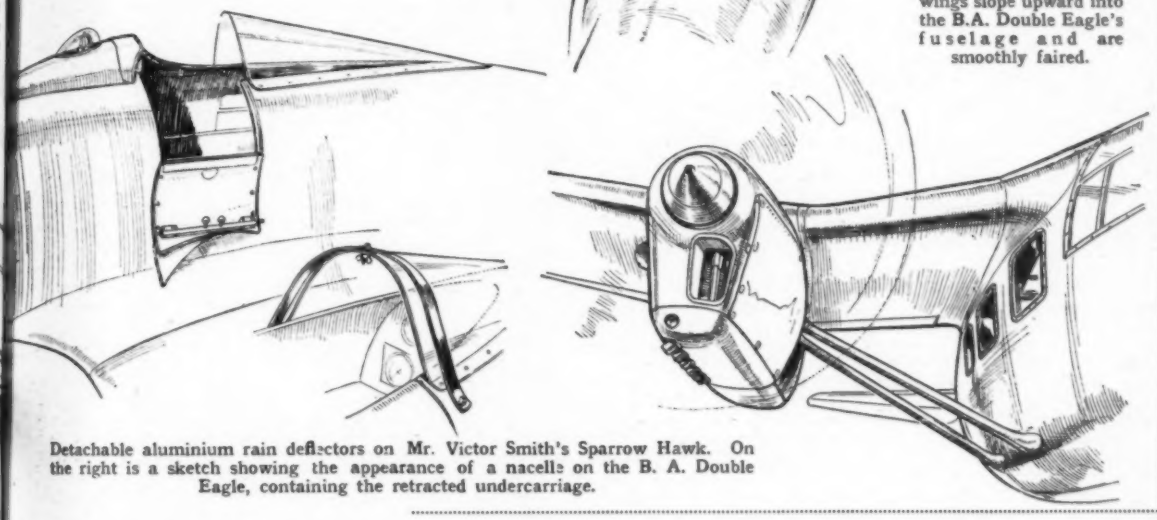
Cruising at something like 175 m.p.h. the range of the twin-engined B.A., with about 150 gallons of 77-octane fuel, was expected to be in the 1,200-mile neighbourhood. Items added since its King's Cup appearance include mudguards and a Harley landing light in the nose.



The inner portions of the wings slope upward into the B.A. Double Eagle's fuselage and are smoothly faired.



Detachable aluminium rain deflectors on Mr. Victor Smith's Sparrow Hawk. On the right is a sketch showing the appearance of a nacelle on the B. A. Double Eagle, containing the retracted undercarriage.

The Booth-Alington Eagle, carrying two salt-sea sailors, was sailing under the name *Frobisher*.

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The entry of the B.A. Eagle in the race is a very sporting affair indeed, being a purely private venture. It is not generally known that Mrs. Alington —mother of the two Alingtons, who are with Lt. Booth, R.N. in the Eagle—is herself a pilot and has made parachute descents. The family has a very long connection with flying, a brother of hers, Patrick Hamilton, having served in the R.F.C. in the early days of aviation. He was killed in 1912.

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Colour schemes in the race vary considerably. No. 1, Major Miller's Mew Gull, is white, with registration letters and wing tips in gold. Its name is *Die Goudstad (The Golden City)*. Capt. Halse's Mew Gull, No. 2, is pillar-box red. No. 3, Victor Smith's Sparrow Hawk, is painted dark blue all over, while Tommy Rose's Double Eagle, No. 4, has a pillar-box red fuselage and silver wings. Scott's Vega Gull, No. 6, has pale blue fuselage and trousers, and silver wings, as has also the other Vega Gull, No. 7, flown by Llewellyn. No. 8, Clouston's Hawk Speed Six, still carries the familiar cream colour with red letters, and probably shares with Major Miller's Mew Gull the honour of having the prettiest colour scheme in the race. The Alingtons' Eagle, No. 10, has dark blue fuselage and wing roots, with silver wings. The Airspeed Envoy, flown by Findlay and Waller, No. 13, is all silver.

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Capt. E. W. Percival seems to be impartial in the matter of V.P. airscrews; he has Ratier electrically operated on Miller's Mew Gull and on Llewellyn's Vega, and D.H. V.P. airscrews on Halse's Mew Gull and on Scott's Vega.

Those who have been regarding the Mew Gulls as high-speed machines with relatively short range will be surprised to learn that by fitting extra tanks for the race Capt. Percival has got the range up to about 1,600 miles. That is on a basis of 10.1 gallons per hour, which the engines will do with the V.P. airscrews. In fact, flying at 8,000 ft. and throttling a little, a consumption of slightly less than 9 gallons per hour can be obtained. Compared with figures of a few years ago this is rather staggering.

Capt. S. S. Halse giving his pillar-box-red Mew Gull an airing over a trio of visitors.

The 7,000 lb. Series II Envoy had been christened *Gabrielle*. Everyone expected it to do very well for itself; with a pair of old hands up front, a brace of well-tried supercharged engines, a pair of comfortably-accommodated assistants, tanks for about 1,460 miles, Marconi receiver and direction-finding gear, and a reassuring parade of dials on the board it was difficult to see where it could go wrong.

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It seemed that the optimum altitude of the smoothly cowled and helmeted Cheetahs of the Envoy was 10,000 ft. Maximum power at maximum speed when receiving the rated boost of plus ½ lb. sq. in. was 355 h.p. at 7,000ft. Their coarsely pitched Fairey airscrews sported handsome spinners, and altogether the installation was impressive to behold. Unfortunately, a spot of bother cropped up when it was desired to screen the plugs. But it didn't seem to worry anyone overmuch. Like the Series II Gipsy Sixes the Envoy's Cheetahs were on 87-octane fuel.

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It transpired that the Envoy turned the scales at something well below its stated weight. The final tankage arrangements were two 53-gallon tanks in the cabin with a smaller 10½-gallon tank above them, and two of 49 gallons' capacity in the wings. So each Cheetah had two of the main tanks to itself, the small unit acting as a balance tank.

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Round the filler caps was boldly inscribed "Stanavo 87 octane" to lessen the chances of mistakes at the stops. A number of other competitors took similar precautions

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A little incident which shows the sort of man Major Miller is happened at Gravesend a short time ago. "Mac" (as he is called by his friends) had just landed after flying the Mew Gull. He then told Capt. Percival that he did not like to tell him before, as he thought it might worry him, but except for a short flight in a Vega Gull he had not flown for two and a half years! "I knew it would be quite all right" was what he told Percival.

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On Friday Scott discovered that he was carrying less payload than Llewellyn, and the removal of a certain amount of upholstery was attempted by way of evening things up. Thoughts of removing one landing light were countered with the statement that, if this were done, the remaining lamp would have to be of the double filament type, which would necessitate a certain amount of re-wiring.

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Victor Smith was the most enthusiastic person at Portsmouth; was obviously deeply in love with his Sparrow Hawk (which was showing 183 on the clock); was delighted with the results he had obtained with the little "blinkers" he could fit round his windscreen if he should run into rain; and although just a *leetle* vexed over his tank trouble on Saturday night was his cheery self again on Sunday afternoon.

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He was the only competitor who could choose his height, for whereas the rest had perforce to cruise at a pre-determined altitude to conserve their fuel, the Sparrow Hawk's high-compression Gipsy Major had 103 gallons on tap and could fly at any convenient level without fear of thirst. Smith planned to operate at 7,000 ft. over Europe, climbing another 3,000 ft. over the lofty African country. Stops were arranged at Belgrade, Cairo, Malakal, and M'pika.

In his lowest seated position he was all but buried in his cockpit, and counted on flying by his instruments for long spells. Being something of a gadget merchant, he had Sorbo pads attached to his stick so that he could grip it with his knees while manipulating his slide rule and maps.

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While it is possible to understand the pilots' desire to save the weight, expense and trouble incurred in the fitting of real drift-indicators, it was surprising to find that, as far as could be seen, only Alington's B.A. Eagle had drift lines or marks painted on the wings. All but one of the machines were low-wing monoplanes. Paint weighs very little, and some method of computing drift, it might be imagined, would be extremely useful while making 1,000-mile hops.

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After certain small additions had been made to the Envoy it was found that it weighed 14lb. less! The mystery was solved when someone remembered that there had been a downpour of rain before the first weighing.

(Left) The crew of the good ship *Frobisher* : from left to right, Mr. C. G. M. Alington, Lt. P. A. Booth, R.N., and Paymaster Lt. R. H. Alington ; they manned the B.A. Eagle. (Right) Auspicious passengers for Maj. Miller, unfortunately not listed at 200 lb. each.

(Left) The reckoning : a study of the weighing of the Llewellyn-Hughesdon Vega Gull. (Right) One of the Envoy's moderately supercharged Cheetah IXs *en negligé* on Saturday night.

THE ROYAL AIR FORCE

SERVICE NOTES AND NEWS — AIR MINISTRY ANNOUNCEMENTS

No. 3 F.T.S.

No. 3 Flying Training School is to move from Grantham to South Cerney near Swindon, when the station at the latter place is ready, which will not be the case until about the middle of next year. This move will leave Grantham vacant for occupation by bomber squadrons.

MARRIED AIRMEN

The following modifications in the conditions of entry to the married establishment and in the rates of marriage allowance will be brought into effect from October 1:—

Married Establishment.—An increase in the total married establishment has been approved. Admission will be granted as follows:—

(i) *Airmen who have completed twelve years' service on their current engagement.*—Such airmen will be automatically admitted to the married establishment on the day following the completion of twelve years' service on current engagement, or on marriage if later.

(ii) *Airmen who have not completed twelve years' service on current engagement.*—(*a*) In order to secure that the reasonable expectations of such airmen of admission to the married establishment under the present system are fully met, they will continue to be eligible for admission to the married establishment under the conditions at present in force for a period of six years from October 1, 1936. At the end of this transitional period, special consideration will be given to any case in which the operation of the new rule would constitute a hardship.

(*b*) At the expiration of the transitional period referred to above, admission to the married establishment will be granted to married sergeants so far as the number of vacancies available permits.

Marriage Allowance.—(i) For airmen whose substantive pay does not exceed 3s. 8d. a day, and who are not on the married establishment, the rate of marriage allowance for a wife, which is at present 7s a week, will be increased by 3s. a week, the addition for children remaining as at present.

(ii) The rate of marriage allowance for airmen not on the married establishment in receipt of substantive pay in excess of 3s. 8d. a day will, where necessary, be increased to secure that the total received in substantive pay and marriage allowance is not less than they would have received if their rate of substantive pay were 3s. 8d. a day. The rates of marriage allowance issuable in respect of a wife of an airman not on the married establishment will thus be:—

For airmen in receipt of	3s. 8d. a day or less	10s. 0d. a week
" " "	3s. 9d. a day ...	9s. 5d. "
" " "	4s. 0d. a day ...	7s. 8d. "
All other airmen		7s. 0d. "

FORMATION OF STATION HEADQUARTERS

A station headquarters will form at Dishforth, near Thirsk, Yorkshire, on December 3, on which date the station will be placed under the command of the A.O.C.-in-C., Bomber Command, in No. 3 (Bomber) Group.

A station headquarters will form at Leconfield, Beverley, Yorkshire, on December 3, on which date the station will be placed under the command of the A.O.C.-in-C., Bomber Command, in No. 3 (Bomber) Group.

These aerodromes may be used with effect from November 5, for aircraft of personnel visiting the station on duty in connection with the opening. Only aircraft fitted with tail wheels will be permitted to land, and no facilities of any kind will be available. The aerodromes will not be available for general use until January 7, 1937.

A station headquarters formed at Turnhouse on August 4.

FLYING ACCIDENTS

The Air Ministry regrets to announce that F/O. Charles Henry Thornton Warner lost his life and L.A/C. John Leopold Bunyan was slightly injured in an accident which occurred at Peshawar on September 21, to an aircraft of No. 39 (Bomber) Squadron, Risalpur, India. F/O. Warner was the pilot of the aircraft and L.A/C. Bunyan the passenger.

Also that Acting P/O. Terence William Rowley, of No. 9 Flying Training School, lost his life in an aircraft accident which occurred at Thornaby, Yorks, on September 22. A.P/O. Rowley was the pilot and sole occupant of the aircraft.

ACCOUNTANT OFFICERS' DINNER

The first annual dinner of Royal Air Force Accountant Officers was held at The Café Royal, London, on Tuesday, September 22. The following were present:—Group Captains H. J. Down, C. G. Murray, and J. Rylands; Wing Cdrs. W. G. W. Prall, J. L. Robertson, and P. J. Wiseman; Sqn. Ldrs. J. M. Adams, F. W. Arthurton, V. G. A. Bennett, H. W. Capener, H. E. Cardwell, R. H. Cleverley, C. C. J. Croydon, P. J. Farmer, W. E. Fisher, O. K. Griffin, A. Holmes, G. W. Lynn, H. A. Murton, and C. W. Price; Flt. Lts. J. R. Ackers, C. E. Aston, B. L. Blofield, J. P. Cave, B. Chadwell, J. Charles, L. Chegwidden, R. W. Collinson, H. D. Connor, C. L. Dook, C. F. Goatcher, J. E. Gregson, S. W. Hill, C. Lorimer, M. H. Luker, C. V. Mears, J. M. Murray, R. W. Pratt, C. G. Prior, J. H. S. Richards, D. Sender, E. Smith, D. C. Stone, R. Trippett, G. H. White, R. J. Wishlade, H. R. Withers, and A. W. Younghusband; F/O.s H. E. J. Acfield, R. F. Fleming, R. O. Heath, W. N. Hibbert, P. J. Holt, R. Peel, C. P. Puckridge, C. G. Sharp, and J. G. Wigley; P/O.s S. W. J. Brown, K. M. Crick, and S. M. Macfldowie; Cdr. J. R. Thompson; Lt. Cdrs. M. D. Johnstone and A. B. Moir; Major G. V. Tolson, and Capt. H. Overton.

ROYAL AIR FORCE GAZETTE

London Gazette, September 22, 1936

General Duties Branch

The following Flight Lieutenants are granted permanent commissions in that rank with effect from the dates stated:—R. J. Bennett, J. A. S. Brown, H. E. Power, H. N. G. Ramsbottom-Isherwood (June 1); J. W. B. Judge (August 16); G. A. Bartlett, M. H. Dwyer, J. Grandy, P. A. Hunter, L. F. J. Taylor (September 11).

The following are granted short service commissions as Acting Pilot Officers on probation with effect from and with seniority of the dates stated:—J. F. Armstrong, R. B. Barker, J. J. Bennett, S. E. A. Brown, R. H. Davis, D. F. Elliot, R. N. Haynes, J. M. Hewson, R. Hutchinson, G. R. N. H. Jan, G. H. John, J. G. W. Jones, C. D. Lavers, W. J. Macrae, G. A. P. Manwaring, J. A. F. Mertens, D. D. Middleton, T. K. Milne, B. A. Mitchell, D. S. Pain, T. H. Parrott, J. H. T. Pickering, T. V. Poltock, J. L. Rees, D. C. B. Riddick, J. E. Riepenhausen, C. A. Rotherham, J. S. Sherwood, F. E. O. Temple-West, E. H. Thomas, G. A. Thompson, J. Tudor-Evans, C. A. Vernieux, H. E. Vickery, J. M. Warren, M. J. B. Young (August 31); R. N. Bateson, R. H. Batt, K. W. Bonnar, F. G. O. Box, A. H. Boyd, A. K. Byrne, A. J. Carver, R. F. Clarke, J. N. Collins, L. M. Craigie Halkett, P. H. Crompton, J. N. Culverwell, B. Drake, J. Dugdale, C. E. Ealand, L. S. S. Edeson, P. Folkes, D. S. Forsyth, R. F. T. Giddings, C. A. Harris, D. B. Harris, K. J. McDonald, A. J. Madge, P. E. B. Martin, P. W. V. Massy, M. I. Murdoch, E. Parker, A. S. Phillips, H. C. M. Pollard, A. A. Proctor, T. W. Rippingale, C. B. G. Robinson, B. Romanoff, R. E. Shorter, W. J. Smith, J. G. W. Swain, H. I. A. Swayne, P. Tomlinson, L. A. H. Wardill, E. D. J. R. L. Whatley, C. M. Wheatley, S. G. Wise (September 7).

The following Flying Officers are promoted to the rank of Flight Lieutenant on the date stated:—A. C. Martin (July 26); F. W. L. Wild (August 10); H. J. Kirkpatrick (August 27); E. V. Knowles (August 28).

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—P. S. Hutchinson, C. C. Byar, W. O. Jones, C. L. Gomm, R. G. Seys (August 7); A. D. Groom (August 19); G. S. A. Parnaby (September 16); H. V. Hoskins (September 19).

Sqn. Ldr. C. H. Potts, D.S.M., is placed on the retired list on account of ill-health (September 9).

The following Flight Lieutenants are transferred to the Reserve, Class A, on the dates stated:—T. H. Downes (September 1); J. H. Heyworth, W. L. Stewart (September 11); H. L. Andrews, P. F. Foss, P. W. Johnson (September 12); M. Griffiths (September 18).

F/O. F. H. Dixon is transferred to the Reserve, Class C (September 1); Lt. G. K. Horsey, R.N., Flying Officer, R.A.F., relinquishes his temporary commission on return to Naval duty (September 1);

the short service commission of Acting Pilot Officer on probation A. D. V. Morum is terminated on cessation of duty (September 4).

Stores Branch

The following warrant officers are granted permanent commissions as Flying Officers on probation with effect from and with seniority of August 28:—F. Gale, C. H. V. Harding, G. Jones, C. E. Lindsell.

The following airmen are granted permanent commissions as Pilot Officers on probation with effect from and with seniority of August 28:—590030 Corpl. F. G. Carle, 590008 Corpl. F. B. King.

Flying Officer on probation B. H. Alder is confirmed in rank (September 5); F/O. H. H. Hilliar is promoted to the rank of Flight Lieutenant (August 3).

Accountant Branch

The following are granted permanent commissions as Pilot Officers on probation with effect from and with seniority of September 4:—C. A. Ball, D. F. Blain, P. S. Gee, T. P. F. Trudgian, G. R. Bowler, P. S. Dundas, W. J. Evans.

Medical Branch

The following Flight Lieutenants are promoted to the rank of Squadron Leader on the dates stated:—R. Thorpe, M.R.C.S., L.R.C.P. (September 2); P. B. L. Potter, M.D., Ch.B., D.P.H., D.T.M. and H. (September 5).

F/O S. R. C. Nelson, M.D., is promoted to the rank of Flight Lieutenant with effect from August 20 and with seniority of August 20, 1935.

The following Flying Officers are promoted to the rank of Flight Lieutenant with effect from September 2 and with seniority of the dates stated:—R. S. Peill, M.B., Ch.B., H. E. Bellringer, M.B., Ch.B., T. J. M. Gregg, M.B., B.Ch., C. M. Carlyle-Gall, M.R.C.S., L.R.C.P., R. L. Soper, M.R.C.S., L.R.C.P., R. S. B. McClean, M.B., Ch.B. (September 2, 1935); A. S. Amsden, M.R.C.S., L.R.C.P. (March 16); A. B. Marshall, M.R.C.S., L.R.C.P. (May 25).

Flt. Lt. W. P. Griffin, M.B., B.Ch., is transferred to the Reserve, Class D (September 4).

Dental Branch

The following are granted non-permanent commissions as Flying Officers with effect from and with seniority of September 7:—C. H. Beamish, L.D.S., E. Martin, L.D.S., A. C. Wilkie, B.D.S.

F/O D. P. Boyle, L.D.S., is promoted to the rank of Flight Lieutenant (September 2).

Chaplains Branch

The following are granted short service commissions, with the relative rank of Squadron Leader, with effect from and with seniority of the dates stated:—The Rev. P. W. James (September 1); the Rev. O. R. I. Jones (September 11).

Memoranda

180774 Cadet D. R. Scholey is granted an honorary commission as Second Lieutenant with effect from the date of his discharge. The permission granted to Lt. J. G. Stevenson to retain his rank is withdrawn on his enlistment into the ranks of the Territorial Army (June 9).

ROYAL AIR FORCE RESERVE

Reserve of Air Force Officers
General Duties Branch

P/O. R. K. Curzon is granted a commission in that rank in Class A with effect from May 25 and with seniority of June 14, 1934: E. K. Rayson is granted a commission as Flying Officer in Class AA (ii) (September 4); G. I. C. Peacocke is granted a commission as Flight Lieutenant in Class C (January 1); P/O. H. M. Goodwin is promoted to the rank of Flying Officer (July 6).

The following Flying Officers are transferred from Class AA (ii) to Class C on the dates stated:—E. T. Scott (July 5); H. D. Ripley (August 29).

Flt. Lt. A. J. Osborn is transferred from Class B to Class C (August 14); F/O. G. A. P. Manwaring relinquishes his commission on appointment to a short service commission in the Royal Air Force (August 31).

The following Flying Officers relinquish their commissions on completion of service and are permitted to retain their rank:—J. B. L. H. Cordes (Capt., R.A.R.O.) (April 1); N. J. Wiltshire (June 17).

The following Flying Officers relinquish their commissions on completion of service:—M. H. G. White (October 26, 1935); G. S. Waller (June 22).

Flt. Lt. E. J. Howes (Lt., R.A.R.O.) resigns his commission and is permitted to retain his rank (September 11).

Stores Branch

Flt. Lt. W. B. Frederick (R.A.F. Retired) is granted a commission as Flight Lieutenant in Class C (July 14).

Medical Branch

T. A. G. Hudson, L.R.C.P., L.R.C.S., is granted a commission as Flight Lieutenant in Class D (September 1); Flt. Lt. D. B. Smith, M.B., relinquishes his commission on completion of service (March 19).

SPECIAL RESERVE

General Duties Branch

The following resign their commissions consequent on the conversion of the Special Reserve to the Auxiliary Air Force:—F/O. A. Andrew (May 25); P/O. R. K. Curzon (May 25).

Medical Branch

Flt. Lt. J. L. H. Easton, M.B., M.R.C.P., M.R.C.S., resigns his commission (May 25).

AUXILIARY AIR FORCE

General Duties Branch

No. 500 (COUNTY OF KENT) (BOMBER) SQUADRON.—F/O. A. Andrew is granted a commission in that rank with effect from May 25 and with seniority of November 15, 1933.

No. 501 (COUNTY OF GLOUCESTER) (BOMBER) SQUADRON.—The following are granted commissions as Pilot Officers:—B. D. C. Wilkinson (August 1); W. B. W. Gracey (July 13).

No. 504 (COUNTY OF NOTTINGHAM) (BOMBER) SQUADRON.—P/O. J. A. F. Mertens relinquishes his commission on appointment to a short service commission in the Royal Air Force (August 31).

No. 601 (COUNTY OF LONDON) (FIGHTER) SQUADRON.—A. M. Crawley is granted a commission as Pilot Officer (July 31).

No. 602 (CITY OF GLASGOW) (BOMBER) SQUADRON.—Baron Stonehaven of Ury, P.C., G.C.M.G., D.S.O., is appointed Honorary Air Commodore (September 22); Flt. Lt. D. F. McIntyre, A.F.C., is promoted to the rank of Squadron Leader and appointed to the command of the squadron (September 2).

No. 608 (NORTH RIDING) (BOMBER) SQUADRON.—F/O. C. W. Wright relinquishes his commission on completion of service (July 21).

Stores Branch

The following are granted commissions as Flight Lieutenants:—Capt. E. P. Dampier (R.A.F., Retired) (May 18); Cdr. R. Burges (R.N., Retired) (July 27); F/O. W. M. Moore (R.A.F., Retired) (July 27); Capt. J. J. Westmoreland (Indian Army, Retired) (July 27).

Flt. Lt. W. B. Frederick (R.A.F., Retired) relinquishes his commission on being granted a commission in Class C of the Reserve of Air Force Officers (July 14).

AUXILIARY AIR FORCE RESERVE OF OFFICERS

General Duties Branch

F/O. R. J. Holland is transferred from Class C to Class A (July 7).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Squadron Leaders.—E. C. Delamain, M.C., to Headquarters, Training Command, Market Drayton; for Air Staff duties, 14.9.36. L. Martin, to Marine Aircraft Experimental Establishment, Felixstowe; for flying duties, 29.8.36.

Flight Lieutenants.—S. O. Bufton, to D. of T., Dept. of A.M.P., Air Ministry, 15.9.36. D. H. Carey, to No. 103 (B) Squadron, Andover, 14.9.36. R. W. Hill, to Headquarters, No. 23 (Training) Group, Grantham, 10.9.36.

Acting Pilot Officers.—A. J. Goldie, to No. 3 Flying Training School, Grantham, 24.8.36. P. H. M. S. Hunt, to No. 8 Flying Training School, Montrose, 6.9.36.

Stores Branch

Flight Lieutenant.—H. J. Hunter, to No. 4 Stores Depot, Ruislip, 7.9.36.

Flying Officer.—J. G. B. O'Hagan, to No. 13 (Army Co-operation) Squadron, Old Sarum, 13.9.36.

The undermentioned are posted to the School of Storekeeping, Cranwell, on appointment to permanent commissions, on probation with effect from 28.8.36:—

Flying Officers.—F. Gale, C. H. V. Harding, C. E. Lindsell, and G. Jones.

Pilot Officers.—F. G. Carle and F. B. King.

Accountant Branch

Pilot Officers.—The undermentioned are posted to the R.A.F. Station, Cranwell, on appointment to permanent commissions on probation with effect from 4.9.36:—C. A. Ball, D. F. Blain, G. R. Bowler, P. S. Dundas, W. J. Evans, P. S. Gee, and T. P. F. Trudgian.

Medical Branch

Squadron Leader.—F. B. C. L. B. Crawford, to Headquarters, Bomber Command, Uxbridge; for duty as Medical Officer, 14.9.36.

Flight Lieutenant.—J. H. Cullinan, to R.A.F. Depot, Uxbridge, 15.9.36.

Flying Officers.—E. B. Harvey, to R.A.F. Station, Hendon, 13.9.36. J. H. Preston, to Medical Training Depot, Halton; on appointment to a short service commission with effect from 21.8.36.

COMMERCIAL AVIATION

— AIRLINES — AIRPORTS —

TRANSPORT RACING : The one machine in the South African race which is equipped as a long-distance machine should be equipped—Waller and Findlay's Envoy. In addition to the safety provided by two Siddeley Cheetah IX engines and full blind-flying equipment, this machine has Marconi two-way and D/F radio and carries a radio operator. (*Flight* photograph.)

THE WEEK AT CROYDON

Devaluation : Appreciation : Irrigation : Hallucination : Natation : Disapprobation

BRITISH pilots on the Paris route are tickled to death about the franc devaluation, and expect to get more fun for their money over there in future. Companies concerned with France and Holland are looking forward to a tourist rush now that the pound is likely to buy something instead of representing a mere waiter's tip. Curiously, there was very little gold by air from France during the financial excitement, but, according to the queer way international finance works, there was a big cargo by K.L.M. from London to Amsterdam—some thirty odd boxes, each as heavy as a man could lift, and representing a total value of around £310,000. These were to be seen disappearing into the wing freight compartments of the big Fokker F22 last Friday.

While on the subject of gold, there were the very large coins which the Emperor of Ethiopia presented, one apiece, to the crew of the special machine which conveyed him to Paris (for Geneva), whither he travelled in order to study the hop, skip, jump and dither tactics of the Vacillations Sub-Committee—or something—which was mumbling over the Abyssinian question. The Emperor remarked to Capt. Jennens, the pilot, and Mr. Martin, the wireless operator, that the coins were not of great value, but might form small souvenirs of the occasion. They looked a bit dingy, but when examined proved to be pure gold and worth around fifteen pounds each! Any shouts of "Heil!" at Croydon will be "Heil Selassie!" in future. Other notable travellers (without the Midas touch, however) by various lines were Mr. Winston Churchill, with a foot of cigar; Mr. Anthony Eden, of mournful mien; the schoolboy Greek Prince Philip, returning to school in England; Sir Philip Sassoon, *en route* by Imperial for an inspection tour of R.A.F. Egyptian and Soudan stations; and Sir Bernard Spilsbury, who flew with Surrey Flying Services and looked at Mr. Joe Chamberlain as though he would post-mortem him for two pins.

An official circular states that a new froth-blowers' outfit is to be stationed at No. 1 bay, C Hangar—a 30-gallon froth fire extinguisher, with which fun may be had by all pending the arrival of the fire tender. This means less hurry for the tender, which will have time to circumnavigate aeroplanes on the tarmac without tearing the wings off them. Another official chit deals with the cutting-off of "domestic hot water" for several days. Anyone might think we had palatial Turkish baths instead of prison-like wash-rooms, where you are lucky if you get anything from the taps except a hollow groan and a couple of dead spiders disgorged into a cracked basin bung-full of tea leaves and fag-ends. *But*, adds the letter proudly, "domestic cold water" will be available as usual. What is domestic cold water, anyway; and why worry when a pannikin held under any hole in the roof gives an ample supply?

Radiation

Considerable strides have been made with the Lorenz equipment during the past week, the framework and the hut at the foot of it having been tastefully decorated with red and white paint in large squares.

Capt. "Timber" Woods, of the rostro-carinate beak (laugh that off, some of you highbrows), tells me that the Croydon Flying Club now has some forty-five members. Several "A" licence members did well in the recent Hereford Race, where the Croydon Club secured third, fourth, fifth and seventh places.

Considerable excitement was caused last week by somebody informing the newspapers that a German bomber, complete with swastika markings, machine guns and all the panoply of war, had landed at Croydon. As a matter of fact, it was an Avro Anson [See page 336.—ED.] in course of delivery to Finland, and the Finnish swastika is differently mounted on its background.

Imperial Airways Social and Sports Club forms a very flourishing part of airport life. Rugger, Soccer, cricket, tennis, rifle shooting, and most other sports are indulged in, and for those the even tenor of whose ways lies in the London office, and who therefore, presumably, find no

Commercial Aviation

drama in aviation, there is even a dramatic club. Frequent inter-company contests take place; last week, for example, there was an excellent swimming display at the Streatham Baths, when Croydon, by only 33 points against 30 scored by Airways Terminus, won the cup presented by Mr. G. E. Woods Humphery for diving.

Many a nasty crack is had at any big air transport by passengers and is received with due humility, for the passenger is always right. One calculated to break the heart of the strongest traffic manager was recorded recently (this is perfectly true, by the way). An old lady, prodding contemptuously at a brand new treadless tyre on a "giant air liner" remarked, "And your maintenance must be positively shocking, for there is absolutely no tread left on your tyres. My chauffeur never lets things go to pieces like that."

A. VIATOR.

A Monospar Freighter

REPRESENTING, it is stated, the first complete British fleet to be built for a Canadian air line, five special Monospar freighters are being shipped to-day to Eastern Canada Air Lines. They were "launched" at Hanworth last Monday by Lady Shelmerdine.

As will be seen from the photograph, a large hatch is the most noticeable feature. Inside, there is a specially stiffened floor and protected walls, while straps are provided for securing freight.

The following load figures are given:—

	lb.	kg.
Tare weight	1,650	750
Fuel, 40 gals. (292 lb.) (182 litres (132 kg.)) ... }	331	150
Oil, 4 gals. (39 lb.) (18 litres (18 kg.)) ... }		
Pilot	170	77
Freight	724	330
Total	2,875	1,307
Cubic capacity:	cu. ft.	m^3
Rear cabin	68.5	1.94
Front cabin	15.5	0.44
Total	84.0	2.38

Payload can be increased by 32 lb. (14.5 kg.) for each 30 minutes flight sacrificed.

Cruising speed at sea level at 3,200 r.p.m. is 123 m.p.h. The engines are Pobjoy Niagara IIs, and the price complete is £1,700.

An interesting point is that the freighter is easily convertible for passenger work, and this explains the window fitted to the loading hatch.

FREIGHTER: The loading hatch of the Monospar freighter, some details of which are given above.

CAIRO-BAGHDAD: At Almaza airport, Cairo, before the start of Misr Airlines' inaugural service to Baghdad. On the left, in white, can be seen H. E. Kilani Bey, of the Iraqi Legation, with the general secretary of the Misr Bank immediately beside him and almost hidden on the left.

The Empire Boats

CALEDONIA, the first of the new flying-boats which will be used for long-range experiments, is now undergoing C. of A. type tests at the R.A.F. station at Felixstowe. *Canopus*, the first to be launched, will, it is hoped, soon be ready for commission.

In a few days she will undergo acceptance trials, and she was recently flown for the first time by Major H. Brackley. It is now expected that she will go into regular service on the Mediterranean at the beginning of October. *Cavalier*, the third of the new boats, is nearing completion. It was originally intended that she would inaugurate the Bermuda-New York service, but, owing to the fact that work on the Bermuda base is not complete, she will follow *Canopus* to the Mediterranean, and a later boat will take her place on the Bermuda-New York route.

BRITAIN HIGHEST!

(*Continued from page 340.*)

is made of rubberised fabric, and is provided with a helmet having a large "bay window" in front. The suit is made in two pieces, the joint being made at the waist with a type of pipe-clip.

A breathing circuit of the closed type is employed, oxygen being fed into the circuit at the requisite rate. The oxygen jet is the driving element in a small injector which produces rapid circulation. From the injector the gas passes through a flexible tube which enters the helmet on the right-hand side of the face and passes across the face and the window to an outlet on the left. The gas, which now contains the exhaled breath, then passes down a flexible tube to a canister containing chemicals which absorb the carbon dioxide and moisture from the exhaled breath. From the canister the gas issues again, as pure oxygen, to be re-circulated through the system.

By way of giving this pressure suit a thorough test beforehand, Sqn. Ldr. Swain donned it and went into the "altitude chamber" at Farnborough. This is a chamber from which the air can be exhausted, and during tests the pressure was reduced to correspond with an altitude of 80,000ft., which is, of course, far in excess of any possible requirements.

PRIVATE FLYING: MODELS

Owing to pressure on space caused by the Johannesburg Race and altitude record news, these two features are unavoidably held over.